ENGINEERING AND MINING JOURNAL

MARCH, 1943

WANTED—Quartz crystals, of radio quality. America's No. 1 critical material. At left, the size preferred. Center, smallest usable size. Right, an unfaced piece but still usable. See page 47

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In this issue

Maintenance Vital at Butte
Gaseous Reduction of Tin From Concentrates
Challenge to Educators in the Mineral Industries
The War Revives New Almaden, Producer of Quicksilver
Phosphate Practice Changes in Tennessee
Cyaniding Sands in West Africa
Sink-and-Float Testing

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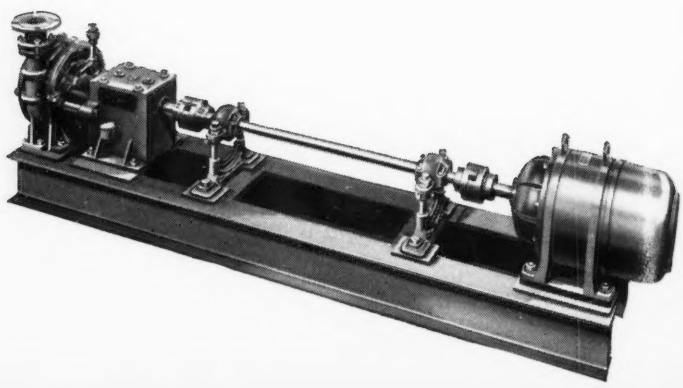

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Mark **April 14** on the calendar —it is Pan American Day—a day with which North Americans should become familiar. Commemorating the creation of the Pan American Union, some 52 years ago, then known as the International Bureau of the American Republics, it merits due attention now when these 21 free and sovereign countries should be closely tied together with a common purpose to preserve their land and institutions against a common enemy. For the mining man, Latin America has long been familiar territory — whether it be Mexico, Brazil, or Chile, the Caribbean or the Andes. Into its distant regions our investors and engineers have gone and from its storehouses new mineral wealth has come to help supply world industry. Air transport of the future, conceived on a vaster scale than anything hitherto developed, will shorten distances and time, promote the interchange of ideas, and preserve a cordial understanding.

▼

E.&M.J.'s pages can now be made to lie flat before the reader when the magazine is opened on his desk, due to improvement in the binding.

▼

Tungsten, in the continuing discoveries of new deposits in the United States and Canada, has provided one of the amazing occurrences of recent years, since the intensive search for strategic minerals began. Use of ultraviolet light to spot the mineral has added a spectacular touch. Of the notable finds, that in the Yellow Pine mine, in Idaho, has been outstanding, tungsten becoming the chief product of the property, which was already yielding gold and antimony. This combination, so unusual on an economic scale, provided the operators with a metallurgical problem complex and difficult. An account of the mining operations and treatment process, by the Bradley Mining Co.'s staff, will appear next month.

A. M. STAEHLE
Publisher

ENGINEERING AND MINING JOURNAL

R. M. WARD
Manager

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H. C. PARMELEE
Editor

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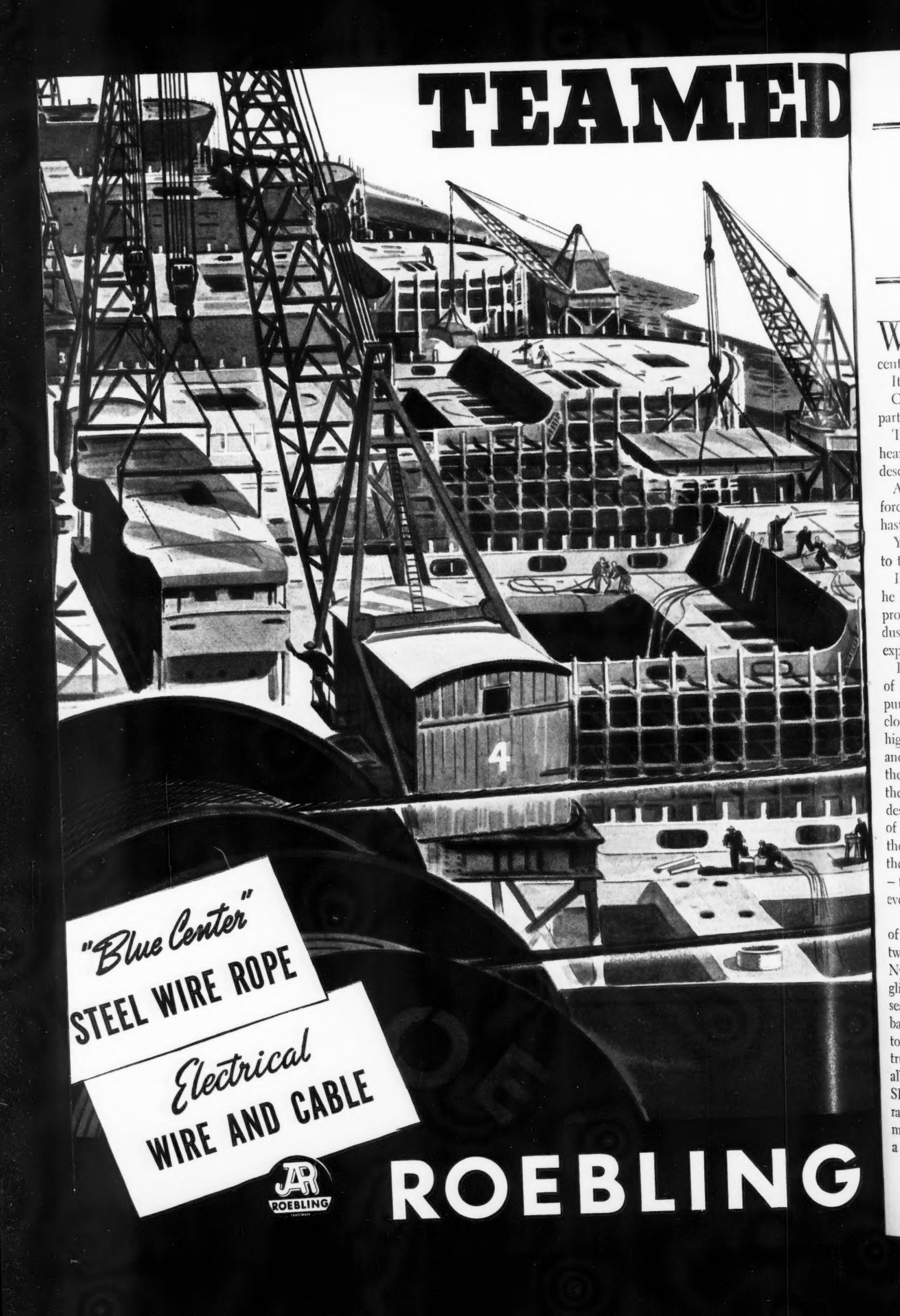
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Textiles—in War as in Peace

World's oldest industry performs modern miracles

WITH ever quickening tempo the friendly hum of the spinning wheel has echoed down the centuries—symbol of a mighty industry.

Its hum is heard today above the din of war.

Capt. Rickenbacker heard it as the lives of his party depended upon a thickness of rubberized fabric.

The hard-pressed soldier on a far-off Pacific isle hears it when he sees fresh supplies and ammunition descending from the sky via friendly parachute.

Adolf Schickelgruber hears it when winter joins forces with the enemies of his ill-clad armies and hastens the day of his defeat.

Yes, man is dependent upon textiles from the cradle to the grave – in peace and in war.

In peace man demands comfort and beauty. In war he must have comfort and protection. The textile industry is coming up to these expectations.

It is developing hundreds of special fabrics for special purposes. It has created clothing for wear, miles high in the stratosphere, and fathoms deep under the sea, clothing to meet the daytime heat of the desert and the bitter cold of its nights, clothing for the tropics and the Arctic, the swamps and mountains – for every climate and every condition.

Modern scientific warfare has forced the development of textiles that were not even thought of a year or two ago: camouflage nets; strong, light, wind-resistant Nylon tentings for the Arctic; heavy Nylon rope for glider towing; parachutes and parachute shrouds; self-sealing gas tanks; panzer hangars; cartridge and powder bag cloths; helmet linings; gas masks; fuses; canvas tops; windshield fabrics and seat upholstery for jeeps, trucks and other motorized equipment; uniforms for all armed services and for nurses, WAACS, WAVES, SPARS and MCWRS. Then there are windbreakers, raincoats, ski-troop uniforms and other items two numerous to mention. The Star Spangled Banner itself is a textile.

The Quartermaster Corps alone has issued specifications for over 300 different fabrics! Add to this the requirements of the Navy, the Air Forces, the various Civilian Defenses, the Red Cross and Lend-Lease and the sum total of textiles required for military and allied uses is approximately 70% of the total produced before the war to meet civilian requirements!

How the textile industry has been able to meet this unprecedented war demand, superimposed upon the industrial and essential civilian needs, is an inspiring story.

First, it stepped up its production to an all-time high. *Textile World's* index of textile-mill activity records three successive records for 1940, 1941 and 1942, the period covering the defense program and the first year of the war. This index for 1942 stood at twice that of an assumed "normal" year. It is noteworthy that this was accomplished mainly with existing equipment.

Second, the textile industry did a job of plant-conversion which was a masterpiece of intra-industry cooperation and idea-sharing.

Third, its technicians developed new and superior fabrics and finishes. Its engineers and production men increased the speed and the efficiency of the entire production machine.

How well all this was done becomes evident when we consider the obstacles to be overcome. Imports of critical fibres have been cut off. There is a shortage of certain chemicals and dyes. There is a high rate of turn-over in manpower and a shortage in experienced labor. It is increasingly difficult to secure machines and repair-parts – just to mention a few of the major problems.

But the textile industry delivered. It has built up an adequate reserve for our rapidly expanding armed services. It is helping to supply the armies of our allies. It is providing for our civilian population . . . all without giving the war leaders a single moment of serious worry.

Major General Edmund B. Gregory, Quartermaster

This is the ninth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

General of the United States, in special statements prepared for *Textile World*, and in addresses before textile groups, has stated that the cooperation of the textile industry has been outstanding and that the industry has kept ahead of schedule on all the major types of fabrics required.

General Gregory recently pointed out that of the approximately 234,000,000 yards of combed twill produced in this country in 1942, the Army took about 87%, the Navy 10%, leaving 3% for non-military purposes.

Col. Robert T. Stevens, of the Quartermaster Corps, in a recent address, referred to the output of duck. Production of that vital military fabric was twice doubled in six months, between January and July 1942, he said, and an annual capacity of 600,000,000 yards of all types of duck was made available. "The current rate of production of cotton duck is five times normal," said Col. Stevens, "and 38% comes from converted carpet, plush and upholstery mills. Based upon known requirements, production in this field is fully adequate".

"Fully adequate" is high praise when it refers to duck production. At the outbreak of the war it looked as if there was no possible chance of meeting requirements, at least during the first year. Nor would there have been if other types of mills had not shifted to making this fabric, and if experienced duck manufacturers had not gone "all-out" in teaching the newcomers, potential post-war competitors, everything they knew about the manufacture of duck. American industry offers many such examples of unselfish cooperation.

Another outstanding accomplishment, made necessary by the interruption of burlap imports, was the conversion of looms producing peacetime fabrics to the production of bag fabrics. The tremendous demand for sandbags, camouflage cloth, food, agricultural and other bagging, caused a conversion order to be issued for the purpose of raising the annual production rate of osnaburg from 263,500,000 yards to 660,000,000 yards, and bag sheeting from a rate of 488,000,000 yards to 855,000,000 yards. The result of this order, and of the military schedules already in effect, was to put the cotton weaving industry about 88% into war, essential industrial, and essential civilian production.

Plant conversion went on with feverish speed. Carpet looms were swung to blankets and duck; the lace industry turned to mosquito netting and insect netting of which it produced millions of yards. The flat-knitting industry with its tricot machines also is engaged in the manufacture of mosquito netting. The sewing thread industry was converted to the production of combed yarns. What once was the silk industry is now doing a tremendous amount of war work. Those mills which had equipped themselves for throwing Nylon yarns for hosiery are now throwing the Nylon for parachutes. That section of the silk industry that was equipped for weaving rayon fabrics is producing fabrics of high-tenacity rayon for flare chutes, cargo chutes and delivery chutes. Many silk and rayon looms that formerly wove clothing materials are now weaving parachute fabrics.

Today practically all Nylon is used for military purposes and the bulk of high-tenacity rayon goes into military fabrics.

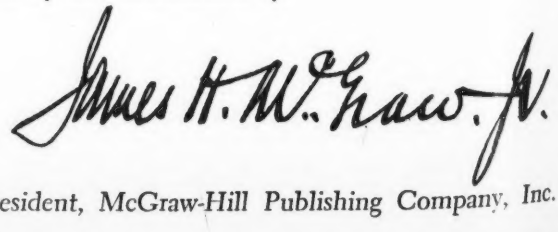
Above and beyond all the new developments is the gigantic job of producing millions of yards of standard fabrics of many colors and weaves. To produce all the uniform fabrics and blankets is in itself quite a job. The woolen and worsted industry has been doing it magnificently. Tent fabrics and summer fabrics produced by the cotton industry are no less a formidable assignment. I could point to myriad other jobs no less impressive.

The production man can indeed take pride in this record and behind the production man, the textile technician has been working tirelessly. Mildewproofing and waterproofing, so vital in a world at war, are in a new stage of effectiveness. A new process for waterproofing fabrics employs vinyl acetal plastic in place of precious rubber. Textiles that glow in the dark have been perfected for black-outs and other applications. American genius is solving problems many of which seemed insurmountable. Silk, for example, was something the Japanese thought we could never duplicate. A new synthetic textile filament that weighs but one eighth of the finest silk filament threatens to put the Japanese silkworm out of business after the war so far as we are concerned. The post-war possibilities of this development challenge the imagination.

Nor has the primary textile industry been alone in its contribution to the war. The textile machinery industry has been converted almost entirely to war work, save for a few facilities required to relieve extreme bottlenecks and supply essential maintenance and repair-parts.

Similarly, some textile mills, particularly hosiery mills hard hit by the silk and Nylon cut-off, are utilizing their space and skilled staffs to produce parts for war equipment.

The immediate significance of all this is its importance in the winning of the war. There is, however, a post-war implication which is important to the future of America. A mass production textile industry will serve civilians after the war more effectively than ever before, and will put new standards within the reach of millions. A long step has been taken toward that completely synthetic textile industry which some observers see in the future. The tempo of such changes has been accelerated tremendously. The oldest industry in the world, now one of America's largest, is showing a youth and vigor that promise much for the future... nationally and internationally.



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Mining Engineering Curricula Shelved in Army-Navy Program

IN A LETTER to the editor, published on page 81 of this issue, Harold L. Walker, head of the department of mining and metallurgical engineering, University of Illinois, calls attention to the unhappy plight of these two branches of engineering education under the Army-Navy college training programs. With no provision for curricula in mining and metallurgy, Professor Walker foresees a disturbance of the educational process that will seriously affect the supply of mining and metallurgical engineers, to the detriment of the mineral industries that must provide raw materials for the military establishment. He rightly deplores what he regards as an unwise step, and urges that something be done about it.

The incident is only one of a series in which the demands of the armed forces have been in competition with normal civilian activities. For more than a year engineering educators in the A.I.M.E. and in the War Manpower Commission have wrestled with one problem after another, first trying to see that Selective Service made the best use of technically trained men, later working for deferment of engineering students to create an Industrial Reserve and improvement of the officer training curricula, and now hoping to save civilian industry at least a corporal's guard of engineers-in-training and averting complete disruption of engineering education.

We are informed that the Army has been persuaded to offer metallurgical training for Army needs to a limited number of students, but that neither Army nor Navy is disposed to consider that it has any need to train young men in mining engineering. At the moment the goal of the A.I.M.E. committee, which we heartily endorse, is to save for the needs of defense industry those students who, having started training as engineers, are drafted before they finish it, and then, for one reason or another, are not assigned to officer training schools. If every engineering student who is drafted, but not eventually selected for officer training, can be sent back to school to finish his course, he will become available for supplying the needs of defense industry instead of wasting his engineering training peeling potatoes or swabbing decks. Possibly this is the best that can be expected in view of the increasingly deeper drafts of the armed forces on the entire manpower of the country. Mining engineering curricula seem to be shelved in the Army-Navy program, but every effort should be made to salvage as many mining and metallurgical students as possible.

Blueprint for Future Cooperation

THE ACTIVITIES of the Combined Raw Materials Board, of which William L. Batt, vice-chairman of WPB, is the American member, have not only been invaluable in facilitating the disposition of raw materials among the United Nations, but the manner in which the board operates seems to offer some hope to those parties who see in intelligent international cooperation the only real hope of preserving postwar stability and permanent peace.

Commenting on the board's activities and policies, Mr. Batt said:

"The first twelve months of operations resulted in stabilization of the raw materials situation. It was recognized that, with the enemy in possession of many sources of vitally needed materials and constantly threatening others, no one of the United Nations could win the raw materials battle alone. Together, we have made great strides toward winning it.

"As the result of the board's activities, world traffic in raw materials among the United Nations now flows in orderly fashion. The board provides a meeting ground where all can go and get a decision —a decision that will be accepted and implemented.

"The board has served to harmonize the various points of view of diverse agencies. In a democracy, that kind of organization is essential. There has been no attempt to set up an arbitrary 'yes' or 'no' system. Instead, the board's efforts at planning and coordinating distribution and use of strategic materials throughout the United Nations have resulted from coagulation of opinion of all interested agencies."

Here is a living example that, given proper leadership and ministration, we can get together with other countries to mutual benefit. Although some members of the mineral industry have already abandoned hope of future world accord and are girding them-

selves for the third World War, we believe that Madame Chiang Kai-shek offered a philosophy that forward-looking Americans will accept with enthusiasm: "... it is the better part of wisdom not to accept failure ignominiously, but risk it gloriously."

Professional Ethics

AN INCIDENT of the recent annual meeting of the A.I.M.E. deserves more than passing notice because it bears on the credibility of technical information released to the press by a federal agency.

Speaking at one of the A.I.M.E. sessions on nonferrous metallurgy, Dr. R. S. Dean, assistant director, Bureau of Mines, gave a scheduled address on "Production of Alumina From Domestic Low-Grade Materials." The topic was timely and attracted an audience of interested and competent representatives of the aluminum industry, War Production Board, National Academy of Sciences, and others. Considering the vital importance of aluminum in the war effort, and the consequent value of domestic sources of raw materials, it was expected that Dr. Dean would contribute something importantly new to the subject, and that lively discussion might ensue. His address, however, was general and devoid of controversial issues, so that little or no discussion developed.

On the following day, however, the *New York Times* carried what purported to be a summary of Dr. Dean's paper before the A.I.M.E., but which was actually a Bureau of Mines release on his address. Had the substance of the press release been embodied in Dr. Dean's address of the previous day, it would have evoked plenty of discussion. The release described a "master plan" formulated by the Bureau to utilize domestic clays, alunite, low-grade bauxite, and other alumina-bearing materials in the production of aluminum. This plan, we understand, was essentially the program formulated sometime before, studied by the War Production Board, and rejected in favor of the program now in effect. So what Dr. Dean told the A.I.M.E., and what the Bureau release credited him with saying to that body, were two quite different stories. The apparent deception aroused unfavorable comment.

This is not the first example of questionable publicity methods on the part of the Bureau since the widely heralded "streamlining" of that organization. Last November the New York daily *PM* published several articles chastising the "metal monopolists" in the WPB and National Academy of Sciences, and inferentially highlighting the patriotic efforts of the Bureau to provide metals for the war. General comment at the time credited the inspiration for the articles to an obvious Bureau source. Nor has the Information Service of the Department of the Interior been guiltless of releasing exaggerated statements of the Bureau's work on behalf of the industry.

Isn't it about time to call a halt to Bureau publicity that smacks of insincerity and seems designed as much to discredit other governmental agencies as to enhance the prestige of the Bureau itself? Misrepresentation, dishonesty, and deception must in the end reflect unfavorably on the Bureau's integrity and damage its reputation in the industry it is intended to serve. The Bureau's worth will be established by its works, and not by unethical publicity.

Stockpiles for Future Security

WE HEARTILY INDORSE the recommendations made at the recent A.I.M.E. meeting (p. 85) that the mining industry should bestir itself to foster legislation by the present Congress setting up a permanent stockpile program. From the economic viewpoint, it would have a stabilizing effect if the mining industry could know the intent of the government in regard to post-war handling of the large stockpiles which it possesses. Many who have observed the tendency of the government to crucify business in recent years will shudder at the thought of placing another club in the hands of some possible unfriendly future administration. Nevertheless, as stated in the meeting, the advantages, both to the industry and to the commonwealth, completely outweigh any reasonable probable disadvantages.

As C. K. Leith pointed out, minerals can be a vital factor in effectuating an enforced peace, such as is implied in the Atlantic Charter, and the value of mineral stockpiles in safeguarding a confederation of peace-loving nations should not be overlooked. Neither should the possibility be neglected of preventing the chronically belligerent nations from accumulating the mineral stocks needed to wage war.

Finally, strategic material stockpiles will afford a vital bulwark to national defense in case the human race becomes insane enough to make it necessary to contemplate another world conflict in the future.

Salute to Mendenhall

AFTER A CAREER of more than 48 years entirely within the United States Geological Survey, Dr. Walter C. Mendenhall, Director of the Survey for the past twelve years, steps down from active service after two deferments of the retirement that almost invariably takes place when a government employee reaches the age of 70.

To have combined outstanding achievement in science with a long record of devoted public service is an accomplishment worthy of any man's respect. To these attainments Dr. Mendenhall added another: he provided for the men who have worked under his direction an environment in which scientific research, technical integrity, and practical skill could flourish, to the enrichment of all mankind. He retires with the good wishes of his associates, in which *Engineering and Mining Journal* is pleased to join.

Reflections from Washington

Washington News Bureau

WPB is turning its attention to the neglected job of keeping the "home front" in fighting trim. This is a significant change in tempo which carries prospects of better days ahead for mine and smelter operations, as well as for other productive facilities.

Home Front Needs Attention

THE effort will be to do for "home front" maintenance what has been done for war production—planned scheduling. During 1942 the emphasis was always on war production. Maintenance of productive plant was something that could wait. Now the need is becoming apparent for programming this minimum essential maintenance of production plant on an equal footing with war production. As WPB Chairman Nelson puts it, the big unsolved problem now is that of assuring a means for keeping the "home front" population healthy and efficient, although not necessarily happy (in terms of providing non-essentials).

Plans for putting mining machinery under a specific production and allocation schedule (*E.&M.J.*, Feb. '43, p. 150) are one step toward this new objective. So is WPB's authorization of the top priority rating of AA-1 for industrial maintenance, effective in the second quarter.

Quartz Crystal Shortage

INCREASING effort is being exerted to develop a domestic source of radio-quality quartz crystals. Requirements have gone up during recent months until this country can use not only all that Brazil can produce but all that can be produced here at home as well. The need has become so great that quartz crystals have become the No. 1 strategic mineral problem. The small interest shown by mine operators and prospectors is believed to be due primarily to two things, a lack of understanding of the seriousness of the situation and the general belief that domestic quartz is inferior to that produced elsewhere. The actual needs are, of course, a military secret and cannot be discussed. But as for the quality of domestic quartz in general, it is as good as any.

In Brazil, where most of the quartz used in this country is produced, about 50,000 workmen are engaged in mining it. A like number thus employed in this country would assure quantity production here where the quartz can reach the market without overseas shipment. Good quality quartz is found in Virginia, North Carolina, Arkansas, California, and good specimens have been received from most of the mountainous Western mining states. At the moment the U. S. Geological Survey has four parties in the field investigating the possibilities of various areas, and this field force is to be expanded as rapidly as possible, particularly in the Western states. Information that is sent into the War Production Board or the U. S. Geological Survey concerning occurrences of quartz crystals will be investigated by the U. S. G. S. as rapidly as the field force can do so.

The mining fraternity can be of assistance in this emergency by sending specimens of quartz to the Miscellaneous Minerals Division, War Production Board, Temporary R Building, Washington, D. C. What is wanted are clear crystals without fracture or discoloration—what is known as "light smoky" can also be used. The tiny sizes are of no value. The crystals should be at least an inch in diameter and from 2½ to 3 in. long. If the diameter is greater, shorter pieces can be used. These specifications are due to the mechanical problems and cost of cutting in addition to the limitations imposed by the use to which they are put.

Even though the crystals are of the size, color and quality described, that they will be of radio quality is not certain. This depends on their piezo-electrical properties—that is, their capacity for developing electrical charges under pressure and of changing dimensions when an electrical charge is applied to them. This can be ascertained only by laboratory test.

Jokers Found in Premium Payment Increases

THE long-awaited official release covering the recent modifications in the Premium-Quota Plan (*E.&M.J.*, Feb. p. 124) contains some reservations that will go far to reduce the increases that might otherwise be anticipated by stating:

"The quotas on which the additional premiums are based may be increased at any time or may be revoked at any time upon thirty (30) days' notice. Metals Reserve Company will not effect any settlement with producers based on the additional premiums in the event of termination of the premium payment program prior to July 31, 1945."

Under these conditions, operators can scarcely be expected to engage in exploration for, or development of, low-grade zinc ore reserves which seem so urgently needed for national security, but are likely to confine their low-grade activity to the mining of ores already accessible.

Mine and Smelter Repair Needs

PROCEDURE for obtaining maintenance, repair and operating supplies under Controlled Materials Plan Regulation No. 5 does not apply to the mining industry. Shortly after Reg. 5 came out early in February, a letter from the War Production Board to the industry announced the procedure that would be followed for second-quarter applications for maintenance, repairs, and operating supplies. Applications are to be made on PD-400 forms (*E.&M.J.*, Feb. p. 121). Smelter and refiner operators holding serial numbers under P-73 were instructed at the same time to file applications on form PD-760, using the same procedure as the mines except for the different form.

Actually, as things stood just after Reg. 5 was issued, mines without serial numbers were completely out in the cold. A revision of P-56 to relieve this situation started through the mill during the month. It provides that "All mines, whether or not they have serial numbers, may secure their maintenance and repair materials and operating supplies through PD-400 applications."

The revised version of P-56 was due to be announced soon after the first of March. It also contains a provision for the mines to secure CMP Class B products, as well as the controlled materials, copper, steel, and aluminum. It was not known the first of March whether the inventory restrictions in CMP Reg. 2 would take precedence over the provisions in P-56 or not. At any rate, until word is received to the contrary, reports on CMP form 7 on inventories need not be filed.

When the second-quarter allocation

of materials was made late in February, the amount set aside for the mines was all that will be needed to take care of the PD-400 applications under P-56. Under the circumstances it appears that mines should have no serious shortage of materials for repair, maintenance, and operating supplies to contend with in the immediate future.

Effective in the second quarter, material and equipment quotas are to be based on orders placed, rather than on deliveries received, as has been the practice up to this time. However, any deliveries received after April 21, based on first-quarter orders, must be included in second-quarter quotas.

Release of 38-Year-Olds

BECAUSE the original limitations on the release of men older than 37 to essential industries were so strict as to make the procedure of little use (*E.&M.J.*, Jan. p. 107), the Army has relaxed the rules governing release of such men. Now, men aged 38 on or before Feb. 28, and drafted or enlisted prior to that time, can be released on their voluntary, written application, accompanied by letters from prospective employers indicating that they will be employed in essential industry.

Manpower Problems

MANPOWER seems to be the biggest problem confronting the fluorspar producers. To deal with the problem, the U. S. Employment Service has set up local offices in southern Illinois and western Kentucky to help recruit additional labor. Also working on the problem is a subcommittee of the Industry Advisory Committee. This group has been meeting at frequent intervals.

To date efforts to solve the manpower problem have been characterized by prompt action on the part of the War Manpower Commission in setting up the employment offices where needed and a reluctance on the part of employers to use the facilities offered.

Effective Feb. 22, WMC ordered a 48-hour week for the non-ferrous metal mines and mills throughout the country, with certain exceptions (see p. 86.

Change in 7-Day Rule

THE Department of Labor has modified its interpretation of the double-time wage payment requirements under Executive Order 9240. Double time is now required only where employees work seven consecutive days in the standard plant work-weeks—that is, any weeks which start regularly with the same calendar day.

Effect of the interpretation is to allow continuance of the 6-day on and 1-day off and the 2-5-5-2 schedules without double-time penalties. Double-time wage payments made prior to February under the Department's previous interpretation calling for extra wages for the seventh consecutive day of work are not recoverable. Since the first of February, however, double time for a seventh consecutive day need be paid only where all seven days fall within the employer's regular work-week period.

Metals Remain Scarce

THE seventh issue of WPB's material substitutions and supply list, issued in February to show the current relative scarcity of over 200 basic raw materials in the war effort, contains no significant changes in the metals field. Bulk of metals and minerals remain in Class 1, which means that supplies are inadequate for war and essential civilian needs and commonly for war needs alone.

Several important metals, however, continue to inch up on the scarcity lists. Since the issuance of List 6 in December, zinc and chromium supplies have apparently tightened—both are listed as among the most critical from the standpoint of the supply-demand ratio in the Class 1 category.

Antimony and lead are the principal industrial metals still in List 3, materials generally available as substitutes for more scarce items. Others in this group are antimonial lead, ferroboron, ferromanganese, gold and osmium. Silver continues to be listed in Class 2, materials generally available in sufficient quantities for war and essential civilian requirements, along with rhodium, platinum, ruthenium, mercury, palladium, indium, calcium, columbium, ferrotitanium, zirconium and alloys, silicomanganese, ferrosilicon, spiegeleisen, silvery iron, and a number of varieties of steel products.

Mining Committees Named

THE membership of the Minerals and Metals Advisory Committee (*E.&M.J.*, Feb. 1943, p. 121) was announced late last month by Howard I. Young, Director of the Mineral Resources Coordinating Division. The men who will advise on the broad general programs are:

War Department: Herbert G. Moulton, consultant to the Resources and Production Division.

Navy Department: Lieut. Com. E. H. Augustus, chief of Materials Branch, Office of Procurement and Materiel.

Board of Economic Warfare: Dr. Alan Bateman, chief of Metals and Minerals Division, Office of Imports.

Reconstruction Finance Corporation: DeWitt Smith, vice president, Metals Reserve Co.

Bureau of Mines: Dr. R. S. Dean, assistant director.

Geological Survey: Donnel F. Hewett, geologist in charge, Section of Metalliferous Deposits.

Bureau of Foreign & Domestic Commerce: Walter Janssen, chief, Metals and Minerals Unit.

Office of Civilian Supply, WPB: Stanley Adams, director, Metals and Minerals Division.

Office of Production Research and Development, WPB: Dr. C. K. Leith, chief, Metals and Minerals Branch.

Facilities Bureau, WPB: Successor to Fred Searls, director, resigned.

Labor Production Division, WPB: Wendell Lund, director.

Stockpiling and Transportation Division, WPB: Dr. W. Y. Elliott.

The Mineral Resources Operating Committee announced by Mr. Young at the same time is composed of Dr. Alan Bateman, Dewitt Smith, Dr. R. S. Dean, and Dr. Harvey N. Davis, director, Office of Production Research and Development. This smaller committee will deal with specific operating plans.

Members of both committees act in an advisory capacity. The power to act is vested in the chairman.

Mine Loan Legislation

LEGISLATION broadening the scope of RFC loans to finance mining ventures for scarce mineral and metal ores was moving through Congress without apparent opposition at the end of February. A measure (S. 381) sponsored by Senator Hayden (Ariz. D.) and approved by the Senate in mid-month would authorize the RFC to lend money to persons "desiring to engage in" production of minerals needed in the war effort as well as to persons engaging in mining. Another measure (S. 12), sponsored by Senator McCarran (Nev. D.), proposes suspension for the duration of the requirement that RFC must determine that a prospective mining property can probably be operated profitably before granting a loan. This bill also passed the Senate but was called back for reconsideration on a minor point.

Both bills are intended to be war measures only. They would expire at the end of the war or Dec. 31, 1944.

Million Dollar Carload

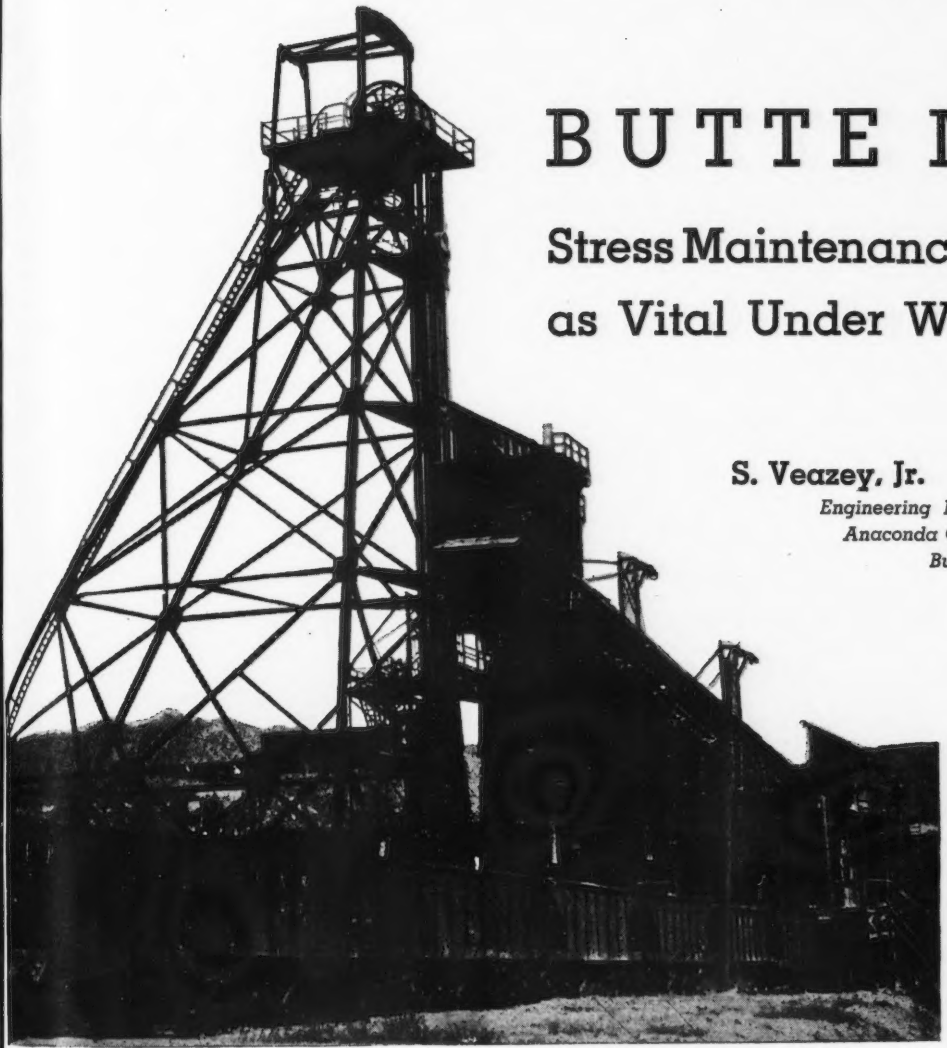
APPROXIMATELY 50 tons of metallic manganese, recovered from low-grade ores with the government-patented electrolytic process developed by the Bureau of Mines at the Boulder City, Nev., pilot plant, has been turned over to the U. S. Treasury for

(*Continued on page* 120)

BUTTE MINES

Stress Maintenance and Salvage as Vital Under War Conditions

S. Veazey, Jr. **H. M. Courtney**
Engineering Research Department
Anaconda Copper Mining Co.
Butte, Mont.



Headframe of the Anselmo mine

TODAY it is vitally important to take care of machinery, keep it running, and make it last, and, in addition, to salvage all scrap metal for re-use. Underground mining conditions are extremely hard on all equipment. Corrosion takes a heavy toll; likewise breakage and exposure to excessive wear, such as that caused by abrasive rock particles coming in contact with lubricated surfaces. Control of tools and supplies is likewise more difficult underground than in surface operations, because of the scattered location of working places.

Nevertheless, much can be accomplished. A program of preventive maintenance should be put into effect to keep usable equipment in good condition. Every possible method of reconditioning machine parts and tools should be studied. Extending their life and usefulness saves metal and releases that much additional factory time to the making of armaments.

Obsolete equipment which is no longer usable can be scrapped. Miscellaneous scrap metals and rubber can usually be collected systematically and shipped. Exact segregation of machine scrap in the shops, however, is not feasible, because the quantities of alloy steels fabricated are so small.

The object of this paper is to present a few ideas and suggestions concerning salvage, reclamation, and maintenance which have proved practical in Anaconda's Butte operations.

Conservation of Rubber—Of all shortages of material, that of rubber is probably the most serious. We are trying to stretch our supplies of it as far as possible in our operations here at Butte, and to return every pound of scrap rubber for reclaiming. To do this we are cutting down the use of rubber where practical, also taking special precautions for the care of rubber equipment, and concentrating on salvage of scrap.

Air and water hoses account for a large amount of the rubber used in the Butte mines. Fifty-foot lengths have been standard for a number of years, but we have found that 40-ft. lengths will do. Experimentally, we are driving some raises with hoses as short as 25 ft., which makes it necessary to keep the pipe lines close to the working floor. Another innovation with which we are experimenting is a collapsible pipe unit consisting of five 5-ft. lengths of pipe connected at each joint with two 90-deg. ells and a short nipple. This gives flexibility for extending or folding up the unit. On the end connecting to the air line a 2-ft. length of hose is used; on the end connecting to the drill there is a 6-ft. length of hose. This makes a combined length of approximately 33 ft., containing 8 ft. of rubber hose, as against 40 or 50 ft. in a regular length of air hose. The device is still in the experimental stage. It is not satisfactory as hose, because it is not as convenient to handle and there is greater pressure drop, but there are places in which it can be used, and results are encouraging.

Metal goosenecks have been developed for the mines to take the place of the usual short rubber goosenecks for connecting water hoses to the

drills. The gooseneck is subject to more severe wear than the main length of the water hose, and the metal gooseneck can be expected to save an appreciable quantity of hose.

Care of hoses is being stressed. Aids to the care of those used with mechanical loaders have been developed, and are well advertised on the job. Posters on surface and underground remind the miners that hoses should be hung up, to protect them from blasting, and that a cut hose "helps the Jap."

Another principal use of rubber in mining operations here is in rubber-covered electric cables. Because of their flexibility they can be re-used many more times than the older armored types of cable; they are easily taken down, coiled, and brought out for inspection and overhaul when no longer needed on any particular installation. For that reason armored-type cable is used only in the largest sizes, such as power cables in shafts.

The technique of splicing rubber-covered cables has been developed so that good sections of damaged cables can be joined together with a vulcanized splice as strong as the original cable, little less flexible, and scarcely any larger in diameter. A cut or break can be repaired with little loss.

Such lengths as must be scrapped are cut open by drawing them through a die with an inserted knife blade. The heavy rubber cover is stripped off and saved.

Similar attention is given to rubber salvage of all kinds. Hoses are repaired at a central shop, and all scrap is reclaimed. Barrels, conspicuously marked, are placed at all mine yards for the collection of old rubber. Abandoned scrap rubber piles have now been "mined" and shipped for reclaiming.

Maintenance of Mechanical Loaders.—There are over 100 mechanical loaders in the Butte mines. The amount of money involved in servicing and maintaining these machines has occasioned fairly close study of maintenance methods. As this type of equipment is now in general use throughout the industry, a brief outline of our maintenance practice and a few suggestions on reconditioning of parts may be of interest.

Responsibility for proper lubrication of loaders is assigned to one or more men at each mine, who also grease, oil, and inspect the scraper hoists. These men are provided with lubrication charts for each type of loader which specify the types of lubricants. A report is made out each time a loader is inspected, showing condition of the loader and necessary repairs. These reports go to the mine foreman and mine machinist, and are followed up by an inspector.

Cost records for mechanical loaders are based on the actual amount of rock handled by each machine (reported after each measurement period by foremen's clerks). Date of last overhaul and work performed since last overhaul are noted on these records. This information serves as a basis for calling the machines into the shops at proper intervals, avoiding use of worn equipment to the point of damage.

Discarded loader parts are saved at each shop, and brought in periodically to the central machine shop or the salvage department for inspection. Only those beyond reconditioning are then scrapped.

Welding is in general use for reconditioning bucket arms, guide racks, couplers, steps, bucket lips, jack shafts, and numerous other parts. Loader wheels are rebuilt by electric-arc welding with an automatic welding head, and by this method can be re-used almost indefinitely. An accompanying photograph shows such a wheel being turned down in a lathe after rebuilding. Mine locomotive wheels are rebuilt the same way.

At outside properties of the company it has been found practical to build up wheels without the automatic welding head.

Buckets for loaders are made in the mine shops, sometimes from salvaged plate. Bucket lips are made with hard-metal welded inserts, and are hard-faced with chilled cast iron. This saves using expensive and less abundant alloy welding rod and results in comparable service life. Bucket lips are standard and interchangeable.

Bucket chains are never discarded until completly worn out. Broken chains are cleaned up by soaking in penetrating oils, followed by wire brushing. If at all usable they are repaired with new links.

Slide-type throttle valves used on one make of loader are reconditioned by grinding out the worn valve chests and buying oversize valves to fit.

Replacement axles for loaders of large size are now bought $\frac{1}{8}$ in. oversize; worn wheels can be machined to oversize bore to fit these axles, or built up for reboring to standard size. When the large axles wear, they may be turned down for fitting with standard size wheels.

Maintenance of Rock Drills.—There are approximately 1,600 rock drills in service in the Butte mines, and the maintenance of this equipment has received thorough study. It is our experience that drills should not be repaired underground, for parts are likely to get lost, drills are improperly assembled, and muck gets into the machines when they are taken apart in the working places. Repairing drills at a central shop makes it possible to carry a smaller inventory of repair parts (important), assures that worn parts which can be reconditioned will be saved, and that drills will be thoroughly and properly overhauled, avoiding unnecessary breakdowns and interruptions to production.

Particular attention is paid to lubrication. No drill may be operated without a line oiler. Clean oil is kept underground in barrels fitted with pumps, and every working place is provided with one or more oil bottles. Use of old cans and like containers for oil is not allowed, as those are natural collectors of muck, as well as being wasteful of oil. As a further precaution against muck getting into and damaging the drills, all air and water hose spuds have inserted screens. Tool boxes are constructed in each working place as a matter of regular practice and drills are kept in these when not in use. Spare drills are kept in lockers. All these precautions tend to lengthen equipment life.

Next in importance to a good program of "preventive maintenance" is careful attention to salvaging and reclaiming worn parts. Welding affords a means for reconditioning a number of these. Anvil-block type chuck bushings, for instance, can be built up by means of stellite applied with an oxy-acetylene torch. Chuck bushings can be rebuilt an almost indefinite number of times. The collar at the forward end of the front-head, which serves as a bearing surface for the chuck bushing, can be built up with mild steel and rebored to size. Flutes of worn rifle bars can be built up with high-carbon steel (though this requires a furnace with accurate pyrometer control for the necessary annealing and heat-treating). Worn or damaged water connection threads in backheads can be annealed with a torch, bored out, filled with brass, and new threads tapped in the brass. Broken stoper rotating handles and valve handles can be repaired by welding.

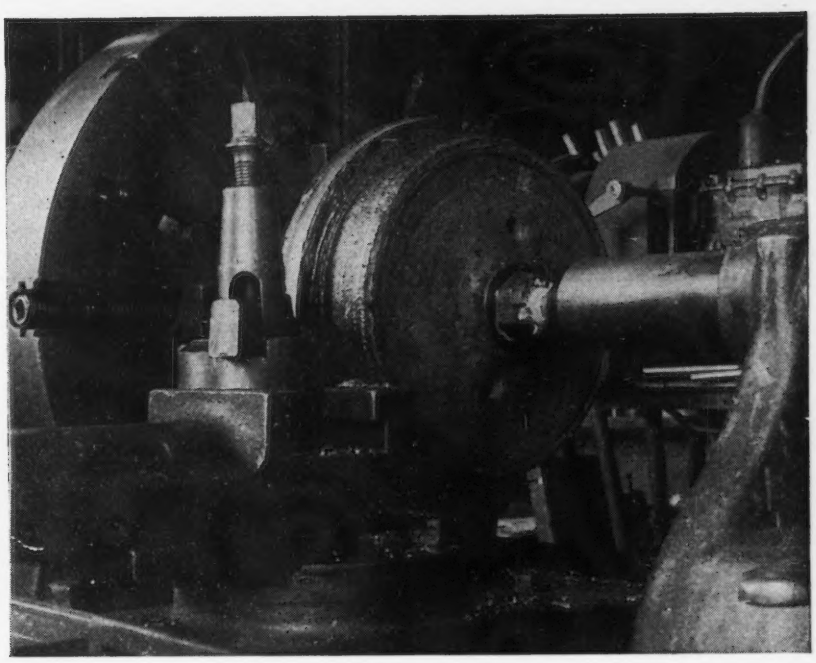
Stoper feed piston bearings, drifter feed screw supports, and crossheads can be rebuilt and bored to size.

Stoper cylinders can be ground to oversize and fitted with oversize pistons. This has the disadvantage of introducing parts not of standard size, however, and we prefer to grind the cylinder to allow pressing in a heat-treated steel bushing, which is then ground to the same inside diameter as a new cylinder. When bushings become worn, they can be pressed out and replaced.

Drifter cylinders have been chrome-plated in considerable numbers, with very good results. The "ways" of a cylinder can be restored to size at the time the plating is done.

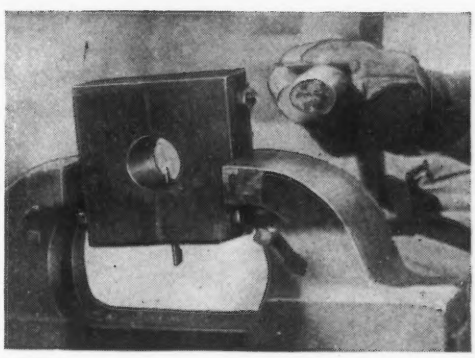
In connection with rock-drill maintenance, it is well to keep in mind the importance of properly shaped and hardened drill steel shanks. Damage to pistons and anvil blocks, and sometimes to cylinders or frontheads, can be caused by poor steel.

Maintenance of Scraper Hoists—The same principles of maintenance are followed with scraper hoists as with drills and loaders. Lubrication charts are furnished to the men responsible for greasing and oiling. There are not as many parts to which reconditioning can be applied as with mechanical loaders and rock drills, but the general principles are the same.



A worn wheel from one of the mechanical loaders is about to be turned to shape in a lathe, after having been rebuilt by arc welding

This aluminum "horn" for a high-speed fan was damaged underground. The pieces were saved and it was repaired by welding



Stripping die used for cutting the rubber cover off scrap electric cable. The sharp knife point slits the cover as the cable is pulled through the hole. These dies are made in the necessary sizes

One interesting innovation in hoist repair that we have begun recently is the repair of brake-drum surfaces of both scraper hoists and timber hoists. These surfaces become grooved in time, resulting in poor brake band contact. To remedy this, we have found it possible to turn down the drum and shrink on a steel band.

Wherever possible, we are using hoists of a design permitting change of motors underground, in case of electrical failure, without removing the hoist from the working place. This saves both expense and production time.

Miscellaneous Tools—A surprising number of tools and miscellaneous items will be found simple to rebuild or recondition if they are studied. An instance of this is the monkey wrench. At one time a damaged monkey wrench was discarded with no further thought. Now, we are using wrenches with replacable jaws and nuts, so that any undamaged part of a wrench can be saved and re-used.

Even the shovel can in some instances be economically reconditioned. In shaft sinking, the handle is subject to such hard use that it loses its strength and becomes too limber to use well before the shovel blade is worn out. Usually this occurs after five or six hours of use. Replacement handles purchased from the manufacturer can be put on the shovels at the mine blacksmith shop at little cost. We have rehandled shaft shovels as many as six times before the blades were worn out.

Scraper sheave blocks and raise blocks should be reconditioned, as these are expensive items of equipment. Nearly any part of these can be replaced or rebuilt.

Valves of many sorts can be cleaned up, fitted with new disks or stems, and used again. The average mine yard contains a sizable collection of old valves which will usually be found to have a large number of usable parts.

To summarize: No tool or part should ever be tossed on the scrap heap until it is certain that none of the modern techniques for reconditioning are applicable. Preventive maintenance of all machinery to keep it in running condition should be stressed now more than ever before.

Reclaiming Oil—On account of the large quantities of oil used in the numerous hoists, compressors, and other engines at Butte, an oil-reclaiming plant was installed some years ago. The first consideration is to see that the oil is used. Proper lubrication is the most important point in maintenance. Today, however, "oil is ammunition" and reclaiming is more worth while than ever before.

Used oil from all sources is brought into this plant and reclaimed by heating, settling out the sludge, centrifuging, and filtering. Most of this reclaimed oil is used for rock-drill oil. If the viscosity and gravity are satisfactory and the oil is free from acid, it needs only to be blended with blown rape seed oil to make it suitable for use in rock drills. About 10 percent of our rock-drill oil is obtained from this reclaiming plant. Other grades too light for rock-drill oil can be cleaned up and re-used in their original applications.

Transformer oil and Pyranol are filtered and reclaimed in this same plant. Oil in all transformers is sampled and tested once a year for dielectric strength, and filtered to remove suspended matter and water if the

oil tests low. If weather conditions and location of the transformer permit, this may be done at the central oil-reclaiming plant; otherwise with a portable Shriver press filter unit which can be taken underground.

Some of the large transformers underground hold as much as 250 gal. of oil or Pyranol, so the portable outfit eliminates a good deal of handling of oil, minimizes interruptions to service, and avoids trouble from condensation of moisture.

Accessory to the oil-reclaiming plant is a laundry for washing waste and rags. These are collected in barrels provided for the purpose at all shops and engine houses.

Scrap pipe, particularly from surface installations (less likely to be corroded than underground pipe) can be used in a number of places for miscellaneous building purposes. Pipe is well suited to this work and by means of welding can be used in many places instead of new iron.

Old boiler tubes are cut up and used for making our underground oil bottles.

Pipe and Fittings—Reconditioning and salvage of pipe used in the mines is now nearly all done underground. Good pipe is rethreaded if necessary; badly bent or otherwise damaged pipe is cut up, saving usable lengths, making nipples of the short lengths, and scrapping the remainder.

We have in service several portable pipe-cutting and -threading machines no larger than mine cars, which can be put on the cages easily and transferred from level to level. The body of the car on which the pipe-cutting machine is mounted is built as a cabinet, containing a wooden tool rack for dies, heads, blades, bushings, and wrenches. Power is supplied from the 110-volt system. Dies are quickly and easily changed. A reaming attachment is provided on the machine. With a nipple chuck, close nipples may be threaded on ½-in. to 2-in. pipe. An auxiliary attachment makes it possible to handle pipe up to 4 in. in diameter.

By the use of these machines, which are as portable as mine cars, the cutting and threading of pipe by hand has to a large extent been eliminated. As the machine will do this work, pipemen are less likely to use pipe with rusty or damaged threads. Handling of salvaged pipe in the shafts is much less than formerly. The savings are obvious.

Conservation of Electrical Equipment—Particular emphasis is placed now on efficient utilization of conductors and other electrical equipment. A program of inspection by electrical foremen has been put into effect in which foremen are held responsible not only for safe operating condition of transmission lines and equipment, but for suitability of equipment to the job. The duty load on cables is watched closely. For instance, a section of a mine may have been provided with two power circuits, but as mining progresses the number of machines and consequent electrical load may be reduced. It is the responsibility of the electrical foreman to take out one of the cables and all excess transformer and starter equipment as soon as the load demand can be carried by one circuit.

Renewed emphasis has been placed on proper maintenance of electric motors as well as other equipment. Fire and electrical hazards are being watched more closely than ever before. Good ground connections are insisted upon.

Many items of electrical equipment which once would have been scrapped when an installation was dismantled are now salvaged and used again. In normal times it is cheap insurance to use only new conduit pipe, on account of the possibility of corrosion affecting the interior of the pipe. Used conduit pipe is no longer scrapped; it is straightened, cleaned, and repainted, painting the inside by means of a swab drawn through it.

Obsolete condulet fittings which once would have been scrapped are now saved and re-used. Contact "fingers" from controllers are salvaged, sent in to the central electric shop, and retipped if possible. Scrap copper from dismantled electrical equipment is saved and shipped.

Silver plating is making possible the use of old electrical equipment instead of new in a number of places. It is used most on contact surfaces of oil circuit breakers and disconnect switches. The silver is applied in paste form, sometimes without having to dismantle the equipment, and is plated out on to the contact surfaces. To do this, the switch contact is made the negative electrode and is swabbed with a brush-like positive electrode, causing the silver to be deposited from the paste onto the contact surface.

A silver-plated surface is not subject to oxidation in the same degree as copper, and silver oxide itself is as good a conductor as the silver. This eliminates a cause of heating and increases the life and carrying capacity of the equipment. Likewise, the freedom from circuit-breaker trouble is reflected in improved and more continuous operation of the system as a whole. This has made it possible to use old circuit breakers and switches instead of new equipment on a number of installations, including one large new electric hoist.

Use of Scrap—Operations at Butte are different than most as regards disposal of scrap iron. We have a foundry at Anaconda where balls for the grinding mills, car wheels, and many other kinds of cast-iron equipment are made. Much of our scrap iron goes direct to this foundry. Some of the remaining scrap iron is used in the copper-precipitating plant.

The highly corrosive nature of the water pumped out of the Butte mines makes it necessary to use phosphor bronze or chrome-nickel steel alloys for pump parts. Many pump-column fittings must be made from bronze. No bronze is scrapped in our operations; any fitting or pump part which has been worn or corroded past the point of usefulness is salvaged.

Brass is salvaged wherever possible. At one subsidiary of the Anaconda company, Inspiration Consolidated Copper Co., it has been found economical to salvage and remelt scrap brass at the plant. Brass is salvaged from worn railroad and mine-car journal bearings and all the other numerous items of brass used in the mines and surface plants. The small brass foundry occupies only corner space in the main shops, and is operated by one man assigned occasionally to this work.

No discussion of salvage at any mining operation would be complete without mention of electromagnets at the conveyor belts. At Anaconda we salvage a large amount of tramp iron which includes nails, small tools such as wrenches, and numerous other items. Everything usable is saved; a surprisingly large quantity of new nails finds its way to the electromagnets. These are sorted and barreled, and sent back to Butte.

Summary

In conclusion we should like to list again the important points to be kept in mind for conservation of material and equipment used in our war effort:

The whole program of salvage and maintenance today rests on the cold facts that metals are scarce and factories are too busy making armaments to turn out any but the most essential industrial materials.

Production of new metal is the first job of the mining industry, but conservation ranks next in importance.

This emergency calls for saving every possible pound of strategic metals and rubber. The best way to conserve these is to keep mechanical and electrical equipment in good running order, so that it will last for the duration. Secondly, every effort should be made to reclaim and recondition worn machine parts and tools, so that only a minimum number of these will have to be replaced. Thirdly, "Get in the Scrap," so that junk material may find its way into armaments.

A Challenge to Educators in the Mineral Industries

Edward Steidle
Dean, School of Mineral Industries, The Pennsylvania State College, State College, Pa.

A college dean sees opportunity to raise the mineral industries to a level commensurate with their importance in national life

DURING A RECENT MEETING of the Society for the Promotion of Engineering Education I had occasion to call on A. B. Parsons, Secretary of the American Institute of Mining and Metallurgical Engineers. He asked my opinion of a new plan of divisionalizatien for the Institute in which the Division of Mineral Industries Education cross-sectioned all other divisions. This recognition of the importance of my profession served as a timely tonic. I had been one of a party consisting of one university president and three deans who contributed to a side show of SPEE which had attracted an audience of six persons! The more I reflected, the deeper the questions burned. Our schools of mineral industries face the greatest opportunity and greatest obligations of all time, and many of them work under terrific handicaps. I do not ask the readers of this article to approve of all of my views. I do very earnestly invite the readers to think about them. It is high time to talk about all phases of mineral industries affairs in terms of the war effort and post-war planning. Let's look at some of the facts.

Background

The increase in the importance of the mineral industries in the past few decades is almost beyond estimation. Measured by dollar value alone we find that mineral production in the United States has grown from $367,000,000 in 1880 to $6,600,000,000 in 1941. True valuation as measured in terms of service to society in peace and war is incalculable. The public has rapidly drifted into a complacent acceptance of what appears to be an inexhaustible supply of mineral products, until rudely awakened by the priorities of a wartime economy. The same complacency is shared by many of us directly concerned with mineral production or the training of men for work in the mineral industries. We have been too modest. We find those activities and curricula related to the mineral industries scattered, submerged, and often ignored in almost every phase of governmental and educational effort. Opportunities to engage in desirable activities related to advancement of the interests of the mineral industries have existed in many organizations. They simply have not been put to use.

There has been a general tendency to allow the affairs of the mineral industries to repose under the broad mantle of engineering. In part this is due to their development. The first indication of independence was the emergence of the "mining" school. Mining has long since become but one of several curricula of equal importance, and the term has become a misnomer for the real purpose and scope of the school so designated. Schools of mines were renamed schools of mining and metallurgy, and finally schools of mineral industries.

Natural minerals are classified as mineral fuels, metallic minerals, and non-metallic minerals; all are non-replaceable. The mineral arts and sciences constitute a distinct, interrelated, interdependent division of higher education. There are four main types of work: (1) earth sciences; (2) mineral economics; (3) mineral engineering; (4) mineral technology. The mineral industries now require three divisions of service: (1) resident instruction; (2) extension and correspondence instruction; (3) research.

The earth sciences are concerned with those divisions of natural science which relate specifically to the earth rather than to the universe as a whole, and include geology, mineralogy, geophysics, geography, and meteorology. Mineral economics relates to the economics and conservation of minerals. Mineral engineering, including mining and petroleum and natural-gas engineering, is concerned with the extraction of minerals from the earth and preparing them for use. Mineral technology includes fuel technology, ceramics, and metallurgy, and is the science and systematic knowledge of primary methods of processing mineral materials into useful articles of commerce.

"Have-Nots"

To be brutally frank, few branches of mineral industries education have very high standing in the engineering and scientific world, and oftentimes must fight for their very existence. Some are considered a nuisance by many college administrators; values are considered on a basis of enroll-

ment. Consequently, departments must take what they are offered or leave it. It is no credit to the industries that five departments of mining perished in recent years. Some of these departments may have been ill, one way or another, but it was not in the best interest of the nation to let them die without treatment. The causes of failure lie deeper than any individual incompetency; they lie in the inadequacy of the whole outlook and the whole method of approach.

There is concrete evidence that mineral industries leaders and the vast majority of educators in these fields believe that the most effective service can be rendered by a unified school. Certainly leading mineral states, the development of which has been based on these industries, need great mineral industries schools.

Present Status

Second only to agriculture, the mineral industries furnish the materials upon which all advances beyond the pastoral stage of human development have depended. Though the fundamental economic conditions surrounding agriculture and minerals are drastically different, we find the former in a much better position with respect to orderly development. Agricultural interests are ably represented at Washington by a department with a Secretary in the Cabinet. The farmer is well organized in the Grange and other institutions and can exert powerful political influence. On the contrary, the activities relating to the mineral industries are scattered in various bureaus in different departments. They occupy a submerged position in which much of their importance is lost and a check is imposed upon them which retards their development. Our mineral resources have been developed haphazardly and often dissipated for want of unified and standard federal and State mining laws. The lack of adequate stocks of critical minerals in our hour of peril is a shining example.

All important mining states have departments of mines as well as departments of agriculture. The departments of agriculture include various agricultural activities, but the departments of mines confine their major activities usually to the safety and health of mine workers. State Granges have committees on education which promote the interests of respective schools of agriculture.

Leadership Lacking

With the federal government as an example, perhaps it is natural that a similar condition exists much further down the line. Take a field with which I am primarily concerned—namely, education:

Inspection of the membership list of the Association of Land-Grant Colleges and Universities shows that not a single representative of the different institutions is connected with the mineral industries. Agriculture, engineering, forestry, home economics, decorative arts, architecture, veterinary medicine, liberal arts, and others are represented. The interests of the lowly mineral industries must suffer more or less complete omission, or accept such crumbs as may fall their way.

The same situation exists with respect to other organizations. Among all of the officers since the start of the Society for the Promotion of Engineering Education I can recognize but one representative of the mineral industries. Similarly, in the organization of Engineering, Science, and Management War Training, U. S. Office of Education, representation of the mineral industries has been conspicuously lacking, although much of this war training is directly related to the production, processing, and use of minerals.

There are no representatives of the mineral industries on the Advisory Board of the Ordnance Department, which has organized training courses for enlisted and officer personnel at Aberdeen Proving Grounds and in certain industries. Ordnance deals with materials but saw no need for mineral representation on the committee. Mineral industries educators lack adequate representation on other agencies, such as, for example, the National Defense Research Council. This has resulted in a failure to utilize to the fullest extent the available laboratories and research talent of various schools in the prosecution of the war.

Examine the Facts

The history of the National Association of State Mining Schools presents a curious and now nearly forgotten picture. This association was organized in 1902 and was active until 1910. During these years the association had enrolled in its membership the leading educators in mining and mineral technology. The object of the association as stated in its constitution was "to secure co-operation and united effort for the advancement of the interests of state mining schools in every way."

The association sponsored legislation in Congress, which, if it had been successful, would have resulted in the support of the mineral industries by the federal government in much the same manner as agricultural interests. The proposed legislation failed to be enacted, and interest in the association declined and finally ceased through failure of united effort.

The demise of this organization is extremely regrettable. Its plan visualized a mutually beneficial organization of those concerned with common problems in mineral education and presented an agency for action superior to anything yet suggested.

For years the A.I.M.E. included all mineral activities under mining. Then, following the first World War, metallurgy was incorporated in the name of the Institute. The original name was supported by tradition, but the new name singled out two branches and left all of the others to be taken for granted. At the present writing more than a dozen societies represent the different branches of the mineral industries and all of them operate independently, some jealous of others in the natural course of events.

The Mineral Industries Education Division of the A.I.M.E. was established on Jan. 15, 1932. The activities of this division are a matter of record and will be familiar to many readers. There is a widespread feeling that this division cannot exercise due authority and cannot meet the growing needs for united action which must represent all the various units concerned with mineral industries education.

In the Institute we find a long list of diverse interests as indicated by the professional divisions and their committees. The concerns of education cross-section all these activities. It may be frankly stated that the Mineral Industries Education Division is failing to live up to its mission. Its pattern of activity is too remote from the problems encountered on the campus, and the inclination is always present to discuss those subjects most closely connected with the members present. An academic discussion of teaching methods of technical subjects is desirable, but it fails completely to meet the fundamental problems of technical schools which control their actual existence.

Divided We Fall

Early in the defense effort, the War Production Board recommended deferment under the Selective Service Act of mining and metallurgical engineers as a group. Petroleum engineers, ceramists, and fuel technologists were not mentioned or given due consideration. The other leading engineering professions were listed separately. Officials in Washington explained that the classification was based on the names of the professional societies, and on the method of classifying mineral industries education in "Engineering, A Career, A Culture," published by the Engineering Foundation in 1932.

This booklet is inadequate and unsatisfactory for the mineral industries and does some schools more harm than good. The chapter on mining is many years behind the times, especially as it concerns coal mining, and the great field of metallurgy was tacked on to mining, giving the idea that it is an optional course. The booklet did not give recognition to the other branches of the mineral industries, in spite of the fact that the A.I.M.E. is one of the sponsors of the booklet.

A recent questionnaire of the American Council on Education grouped mineral industries under Mining-Metallurgy and Mineral Technology. Different branches of earth sciences were listed separately. Apparently no organization representing the mineral industries took the trouble to see to it that various offices in Washington gave due recognition to the different branches of the mineral industries, including petroleum engineering, ceramics, and fuel technology. It is evident that distribution of mineral technologists in the war effort and utilization of the services of educational institutions in this field would be far more effective if appropriate representation existed in Washington.

United We Stand

It is a matter of general agreement that the war must be won before consideration can be given to other activities, however desirable they may be. Nevertheless, the amount of planning for the post-war years now in evidence is an optimistic augury for the future. Examination of the list of planning agencies, some 170 in number, as enumerated by the Twentieth Century Fund, discloses a familiar pattern. The mineral industries as such have no representation, and apparently they do not exist. Whatever their post-war problems may be, they are not receiving the attention they deserve. Similarly, in the annual report of the National Resources Planning Board practically no specific attention is paid to the mineral resources of the country, although their importance in any resource program must be apparent.

The chemists claimed that they won the first World War. Both the physicists and engineers already vie for honors in connection with the present conflict, in spite of the marines. In granting all claims to the contrary, this war, as never before, is a mineral war. Coal, steel, and petroleum may well become the deciding factors. In fact, petroleum alone may decide the outcome. For this reason the members of the Institute now scattered well over the world are making an enormous contribution to the winning of the war, and a contribution of which we are naturally very proud. The mineral industries are now strained to capacity to produce materials for planes, tanks, guns, ships, and munitions. Without these mineral materials, the engineer is helpless. The whole story is one of great interest, and the part played by the mineral industries is a contributing factor, and no small factor, to the war effort of the nation. At the moment mineral industries are "tops" in importance but "bottoms" in unity and publicity.

Suggested Action

These views have been set down with the conviction that they represent the views of the average of all mineral industries educators. I refuse to believe that interest in mineral industries education is at so low an ebb that under the proper conditions only six persons interested in this field can be marshalled together to listen to four papers which have had the careful consideration and the public-spirited cogitation of three college deans and a university president. To my way of thinking, there must be something fundamentally wrong with the way we are approaching these problems. We are letting them defeat us without putting up a stiff enough fight. Let us consider what we might do:

1. Why not redivisionalize the A.I.M.E.; why not choose a more rational name such as American Institute of Mineral Engineers and Technologists; in fact, why not make any and all changes that will bring about greater leadership, unity, and efficiency in the mineral arts and sciences?

2. Why not organize a federation of all of the institutes and societies representing the earth sciences, mineral economics, mineral engineering, and mineral technology, to insure an overflowing measure of co-operation and unity of action on national problems of mutual interest? Why not form a close bond with the American Chemical Society as well as with the Engineering Foundation?

3. Why not actively encourage everyone concerned with progress in mineral industries education to accept the very great responsibility which the growth of these industries has produced and urge the A.I.M.E. to provide the Division of Mineral Industries Education with adequate means to meet these responsibilities?

4. Why not recognize that the aid of public school officials must be solicited on methods of educating promising boys into the mineral industries? Why not urge some elementary work relating to the mineral industries as early as the sixth grade and some experiments in this field in the science courses in the upper years?

5. Why not try to instill in ourselves an Inter-American consciousness? Such a habit of thinking of the twenty-one nations as friendly and co-operative *equals* in the conduct of social, professional, and business relations will achieve the solidarity of the Americas. Why not a Pan American Congress of Mineral Industries? Progress in this direction already has been initiated by the Chilean Institute of Mining Engineers, which sponsored the First Pan American Congress of Mining Engineering and Geology, meeting in Santiago, Chile, in January, 1942.

6. Why not revive the National Association of State Mining Schools under the name American Association of State Schools of Mineral Industries, to include all of the schools in the Western Hemisphere and with the authority that is necessary to further the interests of the schools? Why should not the Division of Mineral Industries Education support such action? Thriving schools will solve Institute membership problems now existent.

7. Why not the establishment of a Federal Department of Mineral Industries with a Secretary possessing the same responsibilities as the other Secretaries in the President's cabinet? The conservation and development of our natural resources present some of the most important problems of our national economy.

To me these are actionable suggestions, but all of them will require able leadership. Why not action be taken now?

For Testing Phosphate Samples Quickly

FOR washing phosphate samples speedily the staff of the Tennessee Phosphate Division of International Minerals & Chemical Corp. has ingeniously adopted a small cement mixer used in combination with a wide, low spitzkasten which serves as a settling hutch. A sample of ore is placed in the mixer and sufficient water added to bring the sample to approximately 50 percent solids. Four old Dorrco rubber-covered 5-in. ball valves are added, and the mixer is started. After 15 min. of mixing at 50 percent solids, diluting water is added by means of a hose while the mixer is still running. The overflow of the mixer passes to a settling hutch, and this procedure is continued until the overflow from the settling hutch is practically clear, indicating that all of the slime has been washed from the sample. With this sample washer it is possible to simulate conditions in the plant, or, if desired, ideal conditions. With its use two men can do the work of seven men washing samples by hand.

Batch Testing for Heavy-Media Separations

Apparatus and procedure that will be useful for laboratory sink-and-float work

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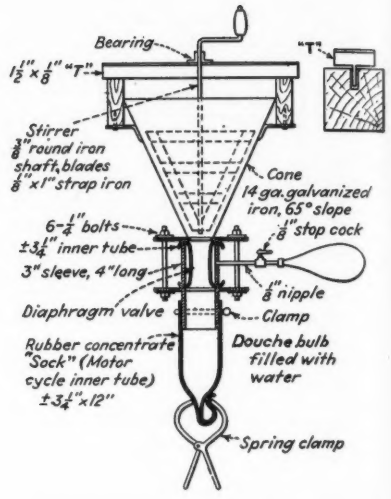


Constructional details of laboratory sink-and-float test unit

BECAUSE of the growing interest in heavy-media "sink-and-float" methods of concentration, the inexpensive laboratory testing unit here to be described should prove useful. It has been successfully used in making hundreds of routine tests. As in the flotation process, it is seldom possible to know by visual examination of an ore just what results might be expected; hence, preliminary testing is necessary. Unfortunately, most ores are not amenable to the sink-and-float method of concentration, but because of the large capacity, low capital, and operating costs of heavy-media separations as compared to other methods of concentration, no operator should overlook investigating its applicability to his ores.

In general, an ore to be amenable to sink-and-float concentration must have its valuable constituents liberated from the gangue at a relatively coarse mesh. Yet, it is surprising how often the disseminated middling products favor a denser phase of the gangue or one gangue mineral in preference to another. Perfect separations can be made where there is less than 1/10 of a point difference in specific gravity.

Either galena or ferrosilicon may be used for the medium when the float product has a specific gravity above 2.5 and less than 3.5. For specific gravities less than 2.5, barite or magnetite may be used. There is no medium for separations above 3.5. The materials mentioned are ground wet in a batch ball mill until all particles will pass through a 100-mesh screen easily. Dry grinding in a disk pulverizer will not make a satisfactory suspension. From 250 to 300 lb. of galena, ferrosilicon, or other medium will be required for testing. In addition to the apparatus shown in the accompanying line drawing, the following auxiliary units will be required:

One 1-in. square-mesh screen 12-in. diameter
One 10-mesh screen 12- to 15-in. diameter
Three 30-mesh screens 12-in. diameter (one for tailings, one for concentrates, and one for the "clean-up")
One water cup with long handle for handling small amounts of medium
One 3½-gal. galvanized water bucket
Four 24-in. diameter galvanized tubs
One small scoop feeder
One small bath spray with short length of hose and adapter to fasten to water faucet
One small tea strainer
One spring postal scale weighing to 5 lb.
One pint Mason jar or cylindrical vessel of equivalent volume
One 12-in. saucepan 4 to 6 in. deep
Twelve or more assorted pans or other receptacles for the various products

The sample of ore to be tested (usually 10 to 12 lb.) is crushed to about ¾ to 1 in. If much talcky or porous gossan material is present, place the crushed sample in a small cylinder (a batch ball mill, without using any balls) and tumble to scour off the objectionable materials. Then screen and wash thoroughly on the 10-mesh screen. In large plants the feed for heavy-media concentration usually is minus 1¼ to 1½ in. and plus ⅛ to ¼ in. Material finer than this is seldom treated, though developments are in progress to handle material as fine as 30 to 40 mesh. Dry and weigh the minus-10-mesh fines so as to calculate the percentage of fines and feed treated by sink-and-float to determine the over-all ratio of concentration.

Next, cut a sample from the plus-10-mesh feed, and weigh both the sample and the feed so that the dry weight of the total plus-10-mesh material may be calculated. Allow moisture to drain off. Immerse the material on the screen in a tub of medium of approximately the specific gravity of the lightest gangue particle, remove, and allow excess medium to drain back into the tub. The purpose of this is to replace the water film on the ore particles with a film of medium to minimize the dilution or variation of the density of the medium in the cone.

Fill the cone about three-fourths full with medium of approximate desired density, and then close the diaphragm valve. Stir rapidly, add a small amount of the minus-¾-in. plus 10-mesh ore, and rotate stirrer slowly. Next remove stirrer and place hand in cone, feeling to see that ore is loosely suspended from top to bottom, except for concentrates. Remove with tea strainer some of the float, and collect some concentrates from the bottom by hand. Examine these to determine separation and ratio of concentration and vary medium density until the result appears most satisfactory. The "feel" (which one acquires with some practice) shows the distribution in the cone, and for satisfactory results there must be no crowding.

Stir rapidly, then take a sample to check density and prepare an additional water bucket with a reserve supply of medium. Add the feed to the cone with the scoop, stirring gently at ± 15 r.p.m. Following this, open the diaphragm valve slowly and allow concentrates to pass into rubber concentrate sock which is attached to the cone in the manner shown in the accompanying diagram. The slight turbulence caused by air escaping from the rubber concentrate sock does no harm. Close the diaphragm valve and add a small amount of make-up medium if level in cone is too low or if cone is too crowded. The rubber concentrate sock can be clamped at various points, according to volume of concentrates, so it may not be necessary to add any make-up medium for most tests. Unclamp the concentrate sock and catch the concentrates in a pan, then drain the medium through a 30-mesh screen and return it to the

cone. Stir rapidly momentarily, then resume normal slow stirring and repeat removal of concentrate. This product, generally small in volume, represents a mixture of concentrates and middlings, usually considered as the "cone clean-up," and in a continuous test, with more elaborate equipment, it would be automatically split between the float and sink. The purpose of removing it separately in this small batch operation is to secure a clean tail and concentrate. Use a separate 30-mesh screen to drain off the medium and return it to the cone. Repeat the "cone clean-up" and finally drain the cone. This final product is the float, or tailing. Drain off the medium on a third 30-mesh screen.

Use two successive tubs of water for washing the three products, and completely remove traces of medium by thoroughly washing under the spray attached to a sink faucet, catching wash water in either of the tubs. Dry, weigh, and assay each product. Check calculated heads as determined from these products, and compare with original head assay.

The medium in the wash water tubs should be screened through a 100-mesh screen before returning it to the medium storage tub. This will be sufficient purification for many batch tests. As the density and fluidity become impaired, table or float the medium, or discard it and make a fresh supply. When ferrosilicon is used, purify by magnetic concentration.

The density of the medium drained from the products should be determined by weighing a sample of medium in a pint Mason jar on a set of postal scales. These should be calibrated to read directly into specific gravity, correcting for the tare of the jar. There should be less than 1/10 of a point difference between the "top" and "bottom" gravity. If a greater difference exists, the medium is not properly ground, or is too badly contaminated, with the result that the test will not reflect the optimum sink-and-float results. If it is desired to test larger samples, the feed can be added to the cone in small amounts at a time, and the floating tails removed with the tea strainer. The concentrates need not be removed until the test is completed, unless the cone is overcrowded. This can be determined by "feeling" as mentioned previously.

The apparatus described could be used in conjunction with acetylene tetrabromide diluted with carbon tetrachloride to the desired density. Neoprene, "doped" canvas, or balloon silk could be used in place of rubber. If one of these chemicals is used, a smaller test unit is indicated, chiefly because of the higher cost, and samples weighing only one or two pounds should be tested.

New Almaden Today

Reopened and equipped with a modern plant, it is again producing quicksilver

John B. Huttl
Assistant Editor

REVIVAL of old mining properties by modern methods is a subject which always commands the attention and interest of mining men. New Almaden, in Santa Clara County, Calif., one-time premier quicksilver producer in the United States, is an outstanding example in this category. Discovered in 1824, the mine produced some 1,040,000 flasks during the period 1845 to 1926—a record surpassed only by the Almaden and Idria mines, in Europe, and Huancavelica, in Peru. Production stopped in 1926 after cessation of underground work during the previous year. The reopening of an old mine has sentimental, historic, and (in war time) patriotic aspects, but the economic aspect is usually dominant. The stockholders who advance the necessary funds must at least be assured of a run for their money.

New Almaden was by current local report in 1935 a worked-out mine, however productive it might have been in the past. In that year certain parts of the property were sold to the Santa Clara Valley Water Conservation District for dam sites to store flood waters. This led to an appraisal of the property. The production records of the old mine and maps of the levels and stopes were fairly complete. Rough notes existed on underground geological conditions. In 1935, C. N. Schuette, consulting engineer of San Francisco, assisted by Francis Frederick, geologist, spent some three months examining the old mine and records. During this time a geologic study of the surface was made and a fair correlation with underground geology was obtained. Parts of the old workings were open, so that even a large expenditure to open the caved ground would still give reasonable costs when measured by the total ground opened by such work. Geologic structures were found that held out promise of ore with further development, and so, on the basis of this examination, the reopening of the mine was recommended as an equitable venture that promised success if amply financed. The meeting of minds and the finding of the necessary funds were difficult, as is usual in such cases, and it was not until 1940 that W. H. Newbold's Son & Co., of Philadelphia, Pa., successfully promoted the venture, formed the New Almaden Corp., and negotiated a lease which was effective May 1, 1940.

The general plan of operation decided upon was to reopen the mine with funds needed for the work to be obtained from treating old mine dumps and low-grade ore in the outcrop areas. Accordingly, all efforts during the ensuing months were centered in building a camp, use being

New Almaden's treatment plant

made of available C.C.C. buildings, rehabilitation of roads, purchase and installation of machinery, inspection of underground workings, and sampling of dumps. The comprehensive sampling campaign undertaken disclosed sufficient commercial dump material to warrant erection of a treatment plant. Excavation of the foundations for the plant was started in August, and the completed plant went into production in mid-November.

The New Almaden property, which includes the New Almaden, Enriqueta, Senator and several other workings, covers about 4,359 acres and extends along the Los Capitancillos Ridge in a northwest direction for some 4½ miles. At the northwest end the width of the holdings is one mile, and at the southeast end, where Mine Hill rises to a height of about 1,760 ft., about two miles. The Mine Hill area furnished the bulk of production in the past, and here underground workings extend to a depth of 2,450 ft. below the top of the hill. As to the geology of the area, it is best to quote from a report by C. N. Schuette, general manager:

"The orebodies of New Almaden lie in Franciscan strata. These Franciscan rocks, which are Jurassic in age, consist predominantly of sandstone and shales with smaller strata of radiolarian cherts and a few limestone lenses and glaucophane schists. The Franciscan sedimentaries are tremendously folded, faulted and crushed, and are intercalated with lava flows and old intrusives here referred to collectively as greenstones. These rocks were intruded in Jurassic times by peridotite intrusions since changed to serpentine. At a later time another period of volcanic activity in the region of the Franciscan rocks resulted in their intrusion by basalts, diabases, and similar basic igneous rocks. These rocks in general came up through planes of weakness previously established by the peridotites, that is generally along contacts of the sandstones or shales with the serpentine. As these later dikes and sills cooled they gave off hot alkaline solutions from which the cinnabar was deposited. Those solutions reaching the surface as hot springs and subsequently diluted by surface waters lost their identity and aside from being hot springs were of no importance. Those that did not reach the surface quickly or directly were trapped and restrained under impervious rocks such as shales or fault gouges which prevented or delayed them from reaching surface. They then circulated in the breccias under the impervious cap rocks and as they slowly cooled and lost pressure the contained cinnabar precipitated."

As pointed out, cinnabar is the mercury-bearing mineral in the ore. Pyrite, quartz, calcite, and dolomite are associated minerals, though opal, chalcedony, and bituminous matter are also found in the mineralized zones. The property at one time was opened by 18 shafts serving more than 100 miles of underground workings.

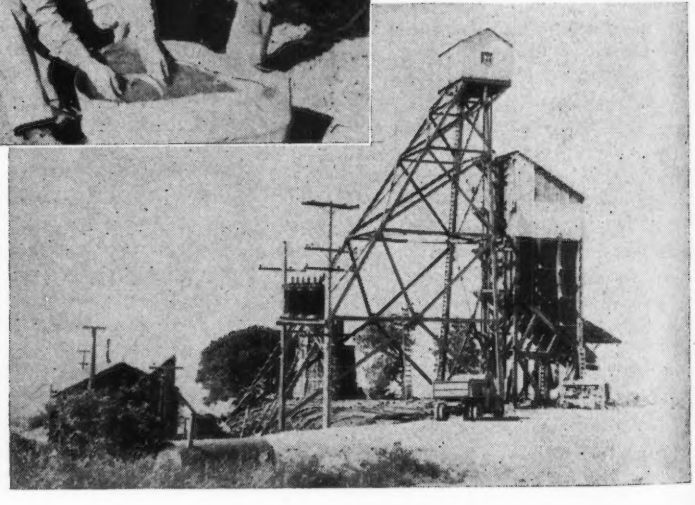
Early mining operations started by New Almaden Corp. in the summer of 1940 were entirely confined to removal of old dumps and outcrop ore by open-pit methods. One of the main open cuts worked during 1941 was that on top of Mine Hill. Here some 25 ft. were removed from the top of the hill, and mining by 25-ft. benches served to exploit available outcrop ore and fill of four old stopes situated near the surface. At the Cora Blanca mine a fairly large tonnage of good ore was mined by open-pit methods from an outcrop area resting on top of an incompleted stope (was not carried to surface) and buried under a large dump. Both operations yielded some 33,795 tons of 3½-lb. ore at a waste-ore ratio of 10 to 1. The Yellow Kid, Jr., mine, one of the outside prospects, also has been the scene of open-cut operations, furnishing a small quantity of ore.

Additional exploration work is currently under way. Dumps removed or under exploitation include the San Pedro, Velasco, Little Grover, Providencia, and China. The work is done with conventional excavating and haulage equipment consisting of three Bucyrus-Erie B-20 ¾-yd. diesel shovels, twelve 5-ton Mack dump trucks, and a Caterpillar D-7 angle dozer, which is also used in road construction and maintenance work in conjunction with a leaning-wheel road scraper. Auxiliary units include a Ford pick-up truck, Hudson station wagon, and a Fageol truck fitted with a Malsbary steam cleaner.

Materials handled vary from dump rock to shales, serpentine, sandstone, caved ground, stope fills, outcrop ore (hard altered silicified serpentine), and ground covered with timber. Selective mining is practiced with good results, and operating costs are low. As open-cut mining is difficult during the rainy season, adequate stockpiles are built up near and around the treatment plant. This is done by sending alternate truckloads of ore to the plant and to the stockpiles, the daily plant returns indicating the metal content of the stockpile in building. Costly sampling and assaying thus are obviated. In the open cuts samples are tested by panning. Relatively little drilling and blasting are done in surface mining operations, and where necessary these are carried out with the aid of two I-R portable compressors, 315 and 210 c.f.m., and I-R S-49 jackhammers.

Underground rehabilitation work was started in May 1941. The general plan of operation called for exploitation of the Mine Hill workings above the 800 level. To make this possible meant immediate opening of the Day tunnel for ventilation, drain-

Bert Mitchell, superintendent (left), panning outcrop ore, with C. N. Schuette, general manager, looking on



The 80-ft. headframe and loading bin at Santa Rita shaft

age, and haulage, rehabilitation of the Santa Rita shaft to permit hoisting of broken rock to the surface, and reopening of the Juan Vega tunnel (300 level). Accordingly, the mouth of the Day tunnel was excavated, followed by opening and retimbering the caved sections of the tunnel. It is now open for its length of 3,600 ft.

Haulage equipment includes a Mancha Mule and 1-ton end-dump cars. The two-compartment Santa Rita shaft has been rehabilitated some 725 ft. to a point below the Day tunnel, where a loading pocket has been completed. The headframe over the shaft is 80 ft. high, and the shafthouse contains a 150-hp. single-drum hoist actuating a 2½-ton skip, and a 680-c.f.m. C-P compressor. Work now in progress includes several transfer raises for dropping ore from the 700 level to the 800 level, whence it will be trammed to the shaft pocket mentioned previously to be hoisted to the surface a short distance from the treatment plant. Waste will be hauled through the Day tunnel to outside dumps near the portal.

As soon as removal of low-grade material from old stopes, mainly between the 600 and 700 levels, is well under way, search for new orebodies will commence. In the meantime, the U. S. Geological Survey has a party of three geologists, L. S. Hilpert, Paul Averitt, and G. D. Eberlein, and two part-time topographers in the field at New Almaden and the nearby Guadalupe mine. At New Almaden geologic studies of the Enriqueta and Providencia areas are being made, as strong but undeveloped croppings may prove to be worth drilling in an effort to find ore quickly.

Haulage and atmospheric conditions governed the selection of the reduction plant site. In view of the numerous points under exploitation on the property, the site had to be central to provide short haulage and face the prevailing one-direction winds in a manner to insure freedom from dust at all times. Such a site was found on a fairly steep hillside a short distance from the Santa Rita shaft. The other production centers are also relatively near. The reduction plant proper is of modern design. Equipment installed is easily accessible and requires a minimum of supervision. The ore brought to the plant in 5-ton dump trucks is dumped onto a steel grizzly, spaced 1½ in., on the rear end of a divided 150-ton coarse-ore bin, with the undersize falling into the end section of the bin, whence it is fed through a chute onto a short incline-belt conveyor discharging into a 175-ton fine-ore bin, the oversize collecting in the front section of the coarse-ore bin, subsequently to be reduced in a 10x16-in. Blake type jaw crusher installed above the conveyor belt handling undersize material. From the fine-ore bin the crushed ore, up to 3 in. flat slabs in size, goes via a chute to an incline bumping feeder discharging into an oil-fired 5x60-ft. rotary kiln. This unit is installed on a slope of ¾ in. per foot and revolves at 1 r.p.m. The lining inside the kiln is 7 in. thick, and consists of a mixture of burned rock, crushed firebrick (takes place of sand), and Lumnite cement. The firing element is a low-pressure Staples & Pfeiffer oil burner. The interior of the kiln is readily accessible when relining is necessary, for the layout of the stationary fire box is such as to permit removal of the front steel cover, with subsequent removal of a part of the front brick wall under a false arch giving an opening large enough for a wheelbarrow to pass. The average monthly output is about 100 tons of ore a day, though this figure at times has been raised to 140 tons.

So far, the furnacing of outcrop ore and dump material has carried the cost of mine reopening as planned.

Only after a trip through the mine and seeing the hundreds of feet of reopened tunnel with heavy top and side spiling and the ground difficulties encountered while reconditioning the Santa Rita shaft can one visualize what an immense job it is to bring an old mine into production.

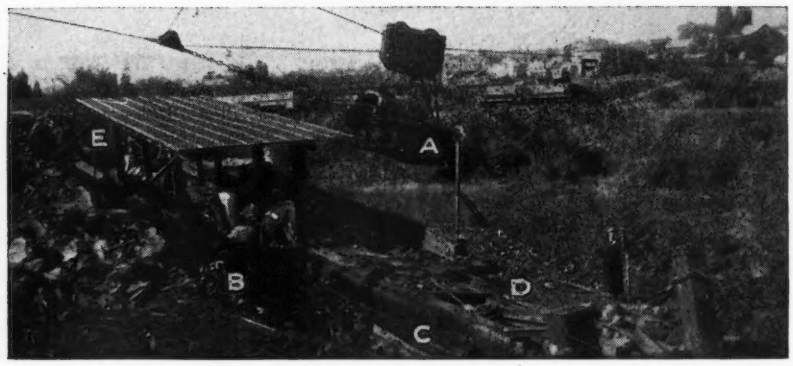
A novel feature in the furnace department is the brick-lined concrete soaking pit below the discharge end of the kiln capable of holding a two-shift discharge of burned rock. As a consequence, the rock needs to be removed on one shift only, with the 1-ton car available for the work being loaded by an overhead arc gate and hand-trammed to the nearby dump. Gases laden with quicksilver generated in the kiln pass successively through a flue-shaped dust chamber, 14-in. Sirocco dust collector, and a pipe condenser, before entering the tile side-hill flue connected to a short tile stack. Collected dust contains only a small amount of quicksilver and goes to waste.

The condenser system designed especially for treatment of low-grade ore consists of a series of four parallel rows of vertical pipes, some 12 ft. high. In each row there are 26 pipes, each measuring 10 in. in diameter, the first and second six being made of iron and 20-gage, 18-8 molybdenum steel respectively, and the remainder of salt-glazed tile pipe. The tile pipes are connected on top by U's, and the metal pipes by inclined H's. Y's connect the bottoms of the alternate pipes on the bottom. These latter Y's stand in Y's of inclined cross pipes, the lower end of which dips into a concrete trough filled with water.

The daily clean-up is accomplished in the following manner: The soot is first washed down the vertical and inclined pipes into stoneware pans below each inclined pipe by a hose nozzle operated through a hole in the cover bared by removal of a cork stopper. The pans are then lifted out of the water-filled concrete trough, the water is decanted, and the contents are emptied onto a soot table set to slope to one corner. The table is made from sheet iron and is 3 ft. wide, 5 ft. long, and 3 in. deep. Next, the soot is sprinkled with lime, and hoed, which causes the quicksilver globules to coalesce and subsequently run to the lower corner of the table and through a gooseneck into a storage pot. Soot residue is returned to the furnace. The quicksilver in the storage pot is cleaned until a perfect mirror surface is obtained. Finally, the cleaned metal is weighed on precision scales, and bottled in iron flasks holding 76 lb. net of quicksilver. The aforesaid operation makes possible a close check on the tenor of the ore treated during the preceding 24 hr. At the clean-up room there also are available a novel bottle-testing machine which applies compressed air to the flask while submerged under water, and a bottle-cleaning unit consisting of a series of power-driven rolls upon which flasks charged with steel shot are rolled. After adequate rolling the shot is removed, and the interior of the flask blown out with compressed air, and thoroughly dried.

Two fans provide draft for the kiln and move the gases through the condenser installation. One is installed between the dust collector and the condenser, and the other at the end of the condenser. Both are of the exhauster type, the first being a No. 35 ABC straight-blade unit, and the second a No. 30 ABC rubber-lined unit. As installed, the fans give adequate suction needed for safety and to guard against loss even with variations in the rate put through and without overloading the individual fan.

Water for the plant operations and camp is obtained from a spring about 4 miles distant from the camp, and electric power is brought to the property by a branch power line owned by the Pacific Gas & Electric Co. Operations are directed by C. N. Schuette, general manager, to whom thanks are due for the many courtesies shown me during my recent visit to New Almaden, and for the information contained in the article. He is assisted by Bert Mitchell, superintendent.



Incline pit is at right. *A*, dragline bucket. *B*, pile of crude ore built up with bucket. *C*, picking trough. *D*, trough that receives the waste rock. *E*, the two slusher hoists. *F*, ramp for dumping truck into railroad car

Unusual Procedure at an Iron Mine

IN THE ISHPEMING DISTRICT, on the Marquette iron range in northern Michigan, are several open pits from which iron ore has been mined in the past, starting about 1852 and continuing intermittently until about 50 years ago.

Due to the present need for hard hematite ore, a small operation was started in the spring of 1942 and was active the past season at the Incline mine, one of these pits, which is 150 ft. wide, 400 ft. long and 150 ft. deep. About 100,000 tons of ore had been shipped from the Incline between 1890 and 1895, but considerable low-grade broken ore had been left in the bottom of the pit and it was this that was the objective of the activity in 1942.

The system of mining used to recover it has been rather unusual. A 1½-cu.yd. dragline bucket was operated on a cable anchored across the pit and was pulled by a two-drum hoist driven with a 100-hp. gas engine. The ore was raised from the bottom with this bucket and deposited on a pile from which a scraper operated by a double-drum slusher electric hoist spread it along a picking trough. After the ore had been spread it was sprayed with water; then a crew of several men removed the rock and cast it into a parallel trough from which it was moved into a truck with another double-drum slusher hoist. When all of the rock had been picked from the ore the first-mentioned double-drum slusher hoist pulled the ore from the end of the trough into a truck that hauled it a few hundred feet and dumped it into a railroad car from a ramp. The latter is shown in the accompanying picture.

This system of mining produced about 100 tons of ore per shift, with an equal amount of rock which was removed. The ore was not of the best grade, but carried sufficient iron to mix with the product from more active and larger producing mines. A. Lindberg & Sons were mining the ore under contract for the Cleveland-Cliffs Iron Co.

New Data on Mining and Pumping Phosphate Debris in Florida

RE-TREATMENT of the material in the débris dumps resulting from the washing of the phosphate matrix produced by Mine No. 9, when it was operated years ago in the Florida pebble field, was undertaken in 1941 by International Minerals & Chemical Corp., then known as International Agricultural Corp. Mining of the débris was done by hydraulic methods. The work was started on Nov. 6 last year and finished April 19, 1942. The débris was pumped to No. 2 recovery plant.

For pumping the débris, old-style 10-in. Georgia Iron Works pumps were used and were spaced 1,500 to 2,000 ft. apart. Each booster pump operated at all times with a positive suction head of 2 to 10 lb. per square inch. Each pump was equipped with a 32-in.-diameter impeller, and was driven by a 150-hp. 590-r.p.m., 2,200-v. slip-ring motor. For this type of pump the over-all efficiency shown at right is very high. This is accounted for by the fact that all motors operated at full speed at all times, thus giving highest motor efficiency and operating the pumps at their most efficient speed, head, and volume.

Contributing to the efficiency of the operation was the careful control exercised by initial test work, and the continual use of recording watt meters and test gages.

The reason for the high pipe-line velocity maintained is partly shown by the following screen analysis of representative samples taken from the débris dumps:

Mesh		Percent
Plus	½ inch	4.2
"	3 mesh	0.7
"	10 "	3.7
"	14 "	10.2
"	20 "	14.3
"	28 "	8.8
"	35 "	13.1
"	100 "	37.6
"	150 "	5.6
Minus	150 mesh	1.8

The analysis shows that there were practically no slimes, most of the material being heavy sand and rock having a specific gravity of about 2.7. The 4.2 percent of plus ½-in. was mostly plus-1½-in. rocks ("mud balls"), which added to the necessity of maintaining high velocity to avoid choking the pipe line.

Facts related are as set forth in a report made by F. B. Bowen, mining superintendent for International in Florida, to R. B. Fuller, manager of International's Florida operations with headquarters at Mulberry. Louis Ware is president of International and Franklin Farley vice president in charge of phosphate operations, and James A. Barr is chief engineer.

The following data on the mining and pumping operations refer to the entire period of operation from Nov. 6, 1941, to April 19, 1942:

Hours pumping débris	1,534.75
Tons débris pumped (long tons)	445,613
Tons pumped per hour	290.3
Volume water used for pumping	3,090 g.p.m.
Mining water pressure on 2-2½-in. nozzles	65 lb.
Normal damp weight of débris per cubic foot	111.64 lb.
Gallons débris pumped per minute	728
Volume of total solution pumped	3,818 g.p.m.
Specific gravity of solution	1.15
Percent solids pumped	29.63
Length of pipe line	6,670 ft.
Size of pipe	10.25 in. I.D.
Velocity of pulp in pipe line (ft. per sec.)	14.82
Pumps in line (10-in. GIW 150-hp. motors)	4
Static head	70.99 ft.
Friction head	465.74 ft.
Friction head per 100 ft. pipe	6.98 ft.
Total dynamic head	536.73 ft.
Power required for pumping débris	1,250,500 kw.-hr.
Kw. hr. per ton débris	2.81
Over-all pumping efficiency (pumps and motors)	54.46%
Power required for mining water pressure	338,450 kw.-hr.
Total kw. hr. used	1,588,950
Total kw. hr. per ton débris pumped	3.57

A Metallurgist Recalls Some Efforts to Recover Tin by Gaseous Reduction of Concentrates

Prof. Carle R. Hayward

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In 1915 I was asked by the late Philip W. Davis, at that time associated with Richards & Co., the well-known Boston metal dealers, to smelt some tin concentrates in the laboratory blast furnace at M.I.T. The furnace had been used successfully for many years in smelting lead and copper ores, and there appeared to be no reason why it would not work successfully on tin; so arrangements were made to carry out the test. The concentrates were mixed with powdered charcoal as a reducing agent, moistened with water to which molasses was added as a binder, and the mixture briquetted and dried. A suitable charge was then calculated, and, with charcoal as fuel, the smelt was carried out. The furnace worked satisfactorily, the slag ran well, and the test seemed to be a success until the products were weighed, sampled, and assayed. The balance sheet then showed that nearly half the tin had disappeared somewhere, and Mr. Davis was sadly told that it must have gone up the flue.

The shock of that unexpected result has never disappeared, and it made of this experimenter an advocate of some substitute for high-temperature smelting in tin extraction.

Later, when the United States entered the first World War and tin became scarce and high priced, the same Mr. Davis asked me to make some tests preparatory to erecting a tin smelter in the Boston district.

The susceptibility of tin oxide to gaseous reduction was first tried by treating a small amount of nearly pure cassiterite in an alundum boat placed in an electrically heated tube furnace. It was found that at 800 deg. C. the oxide was completely reduced by either hydrogen or illuminating gas passed through the tube. The tin coalesced in a single pool.

Here seemed to be a perfect substitute for the usual tin-smelting operations. At 800 deg. C. there was no appreciable fume and high recoveries seemed probable. Unfortunately, however, another sad disappointment came to me, for a 60 percent tin concentrate did not behave the same as the pure cassiterite. This material, similar to that which was to be treated at the proposed smelter, was subjected to gaseous reduction at 800 deg. C. and cooled under reducing conditions. It was found that complete reduction of the tin had taken place, but the metal, instead of coalescing, as it had done in pure cassiterite reduction, remained as small globules distributed through the gangue material.

Numerous tests on various grades of concentrates containing between 60 and 80 percent tin showed that those containing more than 75 percent, reduced to give a completely coalesced metallic product, those between 70 and 75 percent showed varying tendencies toward coalescence, but with concentrates containing less than 70 percent tin, it was difficult or impossible to cause the tin globules to coalesce.

Various methods were used to promote coalescence while reducing the 60 percent concentrate. The one giving best results but still far from satisfactory was to carry out the reduction in an externally heated rotating steel cylinder containing steel balls. Small pools of tin were obtained in this equipment, but most of the reduced material remained as globules or as a coating on the steel.

Various low-melting-point fluxes were added to the reduced ore and the mixture was again heated under reducing conditions with agitation, but no encouraging results were obtained.

It is believed that the difficulties encountered in this work may be due to the fact that the iron in the ore was simultaneously reduced with the tin and an iron-tin alloy formed, the globules of which had surface conditions which opposed coalescence.

Pressure for starting construction of the tin smelter increased, and in view of the difficulties encountered, this line of research was dropped and a small reverberatory furnace constructed in the laboratory to study direct smelting of the concentrates. This work produced helpful data which were used in designing and operating the plant, which was successfully producing excellent tin in the last year of the war.

One phenomenon was observed during the operation of the laboratory reverberatory furnace which is worthy of special comment. The furnace was fired with air-gas burners which could be easily adjusted to produce a reducing or oxidizing atmosphere at will. It was found that when a charge was partly reduced at 800 to 900 deg. C. with a pool of tin in the bottom of the furnace and a pasty slag-ore-coal mixture containing numerous globules of tin rested on it, a reducing atmosphere produced practically no fumes, but a slightly oxidizing atmosphere caused dense clouds of white fumes to roll out of the furnace. Turning the valve to reducing conditions stopped the fume evolution instantly.

The work was stopped soon after these experiments and no proved explanation of these fumes was obtained then or since, but it seems probable that they were tin or a tin compound. If the fumes were metallic tin or tin sulphide, they should have come off under reducing instead of oxidizing conditions. Were the conditions right for the formation of SnO and is SnO volatile under the conditions existing in the furnace? Possibly, but no proof is at hand. Furthermore, is the same reaction responsible for the loss of tin recorded in the early paragraphs of this paper?

In spite of the lack of success in recovering tin by gaseous reduction of concentrates, I have continued my interest and have encouraged several students to conduct research in this technical field in the M.I.T. laboratories under my direction.

In 1921 two undergraduate students, S. W. Butler and A. H. Tassler, incidental to some concentration tests on tin ore, made a few reduction tests in an electrically heated tube furnace using illuminating gas as a reducing agent. They found that cassiterite would readily reduce at 900 deg. C., the tin appearing as small globules.

In 1927 C. S. Stephano, working for a Doctor of Science degree, did considerable work on a Bolivian concentrate of the following composition: tin 28.5 percent, iron 24.6, sulphur 1.45, arsenic 0.26, antimony 1.83, copper 0.08, bismuth 0.48, lead 3.60, alumina 9.20, silica 8.10, barium oxide 2.0.

A careful mineralogical examination indicated that the most important con-

stituents were cassiterite 36 per cent, hematite 35, galena 4, barite 3.0, stibnite 2.5, other sulphides 18, silica and silicates 2.

The material was roasted to remove nearly all the sulphur and then reduced in a rotary, electrically heated tube furnace at 825 deg. C in an atmosphere of illuminating gas. It was found that slightly over 98 percent of the tin was reduced to metal by this treatment. As in the earlier work reported in the foregoing, the reduced tin was in the form of small globules.

An attempt was made to concentrate the reduced tin on a Wilfley table, but the beneficiation was very slight and a minor percentage of the tin reported in the concentrate. A microscopic study of the products indicated that various other material was attached to the tin particles and affected their behavior on the table. This type of work was abandoned in favor of other methods, so it cannot be definitely stated that it would not succeed under improved conditions. In fact, with suitable classification before tabling, there is chance of success.

A portion of the reduced material was treated by flotation, the procedure being based on the Calumet & Hecla method for native copper as practiced at that time. Previous to flotation the material was finely ground in a pebble mill. The treatment showed that practically all the charge floated and no appreciable concentration was obtained. This result was explained by the fact that most of the particles were coated with carbon during the reducing operation, the carbon resulting from the decomposition of hydrocarbons in the reducing gas. It is possible that a different result would have been obtained if the reduction had been made in a gas which contained no hydrocarbons.

Stephano next turned his attention to leaching, and after trying various reagents succeeded in dissolving nearly all the reduced tin in cold H_2SO_4 solution to which vanadic acid and chromic acid were added as catalyzers.

The solutions contained excessive amounts of iron, and attempts to recover the tin by electrolysis were only moderately successful. No attempt was made at that time to remove the iron from solution, but it was believed that this could be accomplished by hydrolysis.

Just before Stephano finished his work, a paper was published by Fink and Mantell (*E. & M. J.*, Vol. 125, pp. 201, 325, 453, 1928) giving the results of some research which had been conducted independently. In so far as the tests paralleled one another the results were confirmatory.

In 1937 Harry Udin, conducting some thesis research for the B.Sc. degree, used a portion of the same concentrate used by Stephano. He had first intended to work on the recovery of tin from solutions made by Stephano's method, but had considerable difficulty in duplicating the leaching results. While engaged in this work he read a paper by A. G. Hotchkiss (*Metal Progress*, Vol. 31, 376, 1937) showing that with mixtures of steam and hydrogen at various elevated temperatures it was possible to have either reducing or oxidizing conditions in respect to iron. It occurred to Udin that it might be possible to use this principle in such a way that by subjecting his roasted concentrate, containing SnO_2 and Fe_2O_3, to the action of steam and hydrogen at a suitable temperature he might reduce the SnO_2 to tin and leave the iron in an oxidized condition. After some experimenting he was successful in doing this and subsequently dissolving the reduced tin in a caustic soda solution.

In 1941 Crosby F. Baker, working for a Master's degree, took for his research the perfecting of the work initiated by Udin. He had no difficulty in reducing the tin to metal and leaving the iron as oxide, but was never able to dissolve all of the reduced tin in a caustic soda solution. It is still possible, however, that a slight change in technique would produce the desired result. The size of tin particles seemed to increase with the reduction time, so, to increase rapidity of solution, the time of exposure to the reducing gas was kept at a minimum.

It seems to me that Udin's discovery opens up several possible improvements in tin metallurgy. If reduction is carried out with steam and hydrogen or possibly with water gas and steam or even suitable mixtures of CO and CO_2, an iron-free tin uncontaminated by deposited carbon could be secured. This tin could be dissolved by leaching in the manner developed by Stephano or by Udin and Baker and recovered by electrolysis.

A second possibility is concentration of the reduced tin by flotation or gravity methods and a third possibility is to cause coalescence of the tin particles by heating above the melting point of tin under palm oil or a suitable flux, accompanied by agitation.

The iron-free tin should act more favorably under these treatments than the iron-bearing tin, coated with carbon, obtained by total reduction such as I used in the early work and later by Stephano.

I hope to carry out similar and complementary tests at an early date.

A Novel Haulage System

A FEATURE that excites the interest of visitors to the Friant dam construction site, in California, is the efficient way Griffith Co. and Bent Co., contractors, handle prepared aggregate. The material is hauled to the storage bunkers serving the mixing plant in trains made up of seven 65-cu.yd. bottom-dump cars with a 300-hp. diesel-electric locomotive at either end of the train. Only one operator is required, however, because controls on the two locomotives are interconnected and are operated from either cab. He moves from one locomotive to the other when the direction of travel is reversed, simply to be where he can see ahead.

In addition to duplicate train and brake control, compressed air connections extending the length of the train provide either cab with means for simultaneous opening and closing of bottom-dump gates in all cars. Compressed air for this service is obtained from the units serving the brake system. Extra receivers (2x6-ft. cylinders on each locomotive) are used to provide additional storage capacity. Pressures up to 70 or 80 lb. per sq.in. are generated, although 25 to 30 lb. is sufficient to operate the dump gates. These special air lines are coupled from car to car by standard air hoses when the train is made up. The dumping control in each cab consists of a four-way valve, the two positions corresponding to closed- or open-dump gate cylinders.

In addition to the gate control, three cars of the train are fitted with air jets for breaking up any tendency of sand to axle and thus interfere with free discharge. These air lines, however, are not served from the cabs but are controlled by a helper who makes an air-hose connection from a stationary supply piped to the point where the train discharges.

The controls from one cab to the other, which are carried through all car couplings, consist of eleven conductor cables and four compressed-air lines as well as the usual air line for brakes. As there is no occasion to take cars out of the train except for repairs, these connections do not have to be made often.

The aggregate train discharges into a seven-compartment track hopper (five rock, two sand) near the dam site. Hopper compartments are in the same order as the gravel plant, spaced so that the seven cars of the train can be dumped simultaneously at one spotting. From the track hoppers the materials are belt-conveyed to the mixing plant.

Sand Leaching at Nangodi

A small-scale cyanidation enterprise at a remote spot in West Africa

W. H. Dennis

Nangodi Gold Mine
Northern Territories, Gold Coast
West Africa

▶THE AUTHOR *finds that numerous problems can arise in the course of cyaniding some low-grade materials in a plant equipped with leaching tanks and zinc boxes for precipitation. Despite the "old-fashioned" procedure followed, his experience may interest a good many small-scale operators.*

ALTHOUGH the trend of cyanidation practice has been away from leaching and towards all-sliming and counter-current decantation methods, hundreds of small (and large) plants in Africa, Australia, and elsewhere are still operating with the old-fashioned leaching tank system. It appeals to the small man because of the "comparative" simplicity of operation and low costs of power and labor (in Africa). I have said "comparative" advisedly. Snags and difficulties soon crop up, and to obtain an economic extraction requires vigilance, common sense, and frequently a fair metallurgical knowledge. I wish to discuss some of these difficulties which have arisen while I have been running a small 100-ton leaching plant at Nangodi, British West Africa. Nangodi mine is 400 miles off the beaten track, and this isolation, coupled with high charges for transport from the coastal area, creates many unique difficulties. Numberless are the expedients and improvisations necessitated.

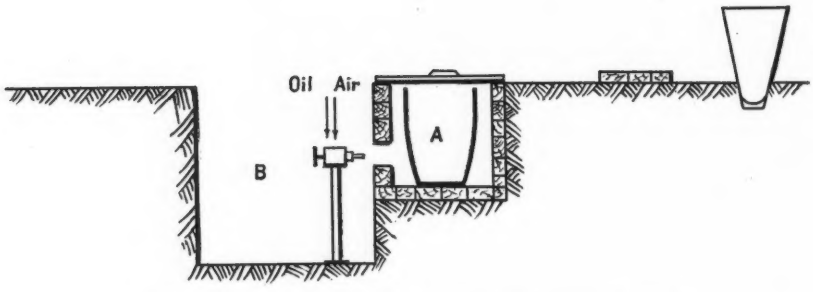
Current mill products and those already stacked on the tailings dump consist, broadly, of a clean white sand and a graphitic, pyritic black sand. Complicating matters somewhat are piles of black and white slimes which have been headpanned by the native laborers and dumped indiscriminately on the tailings.

Preliminary tests had indicated a recovery of 70 percent on the white sands (head value 3.4 dwt.) and 50 percent on the black refractory sands (heads, 2.5 dwt.). The gold in the latter is associated with iron pyrite and arsenopyrite. Graphite is also present, but tests have shown that it plays no part in the low extraction. Obviously the proper treatment for the black sands is flotation and cyanidation, but, unfortunately, the quantity (20,000 tons) would not warrant the cost of the necessary plant, so leaching was adopted. They were kept separate as far as possible and left on one side to be treated last, in the hope that continued exposure to oxidation by the air would work some good.

Classification — As the sands and slimes in the tailings dump were very indifferently separated, the need of some form of classification was indicated. A single-rack machine had already been acquired, and this was set up on the dump. As dropping the sands directly into it would give it no chance to operate efficiently, a wooden V-shaped launder was fitted at a gentle slope to the classifier's feed launder. The V launder, being at right angles to the machine, was easily accessible for dumping the sands from the headpans into it, a water feed pipe at the upper end sluicing the sand down into the classifier. This worked fairly well for a time, but, finally, mechanical classification had to be abandoned in favor of hand separation, water becoming scarce. For six months no rain falls, and although we have large storage dams, the water gradually disappears, owing to seepage and evaporation, and for the last two months of the dry season we limp along as best we can. Some of the slime, however, had previously been segregated roughly and was piled on the sand dump. This was put on one side and the sand remaining was charged to the leaching tanks. Strange to say, extraction fell off but little, although the sands contained 25 to 30 percent slime. One would have thought that this sand, consisting of masses of particles of varying size, would channel at the points of least resistance—that is, in those areas consisting of coarse particles. Probably the upward method of leaching used is the explanation. I will discuss this more fully further on. If the sands contain slime in lumps, they will absorb solution which remains in them when the tank is discharged, so leading to loss. In such a case it is advisable to dry the lumps, break them up and mix with a large proportion of sand. A further point in respect to channeling can be made. It is usual at small plants for the sand to be brought to the tanks via an overhead line from trucks, so that it discharges at the same spot in the tank, leading to compression of the sands and rendering this particular area impervious to the leaching solution. This is another cause of channeling, adversely affecting the extraction. A simple remedy is to place a wooden grating inside the tank to impede the fall, this being raised as the level of sand rises. Lime is added to the trucks, either lump or slacked, the rate being 1 lb. per ton for clean sands.

Leaching—The tank being charged and raked level, the first strong solution is admitted. Solution strength depends on the nature of the material and the condition in which the gold occurs. Clean tailings containing no coarse gold can be leached with 0.1 percent KCN (2 lb. cyanide per ton). The tank in which the solution is made up is provided with a line to a blower or compressor, insuring that the contents are well mixed and that the solution is well aërated, for oxygen is essential to the dissolution of the gold. The solution can be run in by gravity via the bottom—that is, underneath the filter cloth, percolating upwards and forcing the water contained in the sand in front of it until it eventually overflows the tank. This is continued until the overflow shows definite evidence of cyanide. Where water is scarce, this displaced moisture can, by a pipeline let into the top of the tank, be collected and used as a final wash. It would amount to anything up to 15 tons on a 100-ton sand charge.

After the solution for the first leach has been in contact for 18 hours or so, the second leach solution (0.05 percent KCN) is admitted, also via the bottom valve, so that it pushes the first strong leach (now containing the values) uniformly before it until the full quantity of this pregnant solution has overflowed and gravitates to the precipitation unit, the rate being regulated by the time required for efficient precipitation. This second leach is then withdrawn from the bottom and pumped to the solution tanks (as it is generally too poor in gold to precipitate) and forms the first leach solution for another charge after being brought up to strength with fresh cyanide. The sands are raked over the surface with the idea of entrapping air (oxygen) and a water wash is then added on the top, allowed to take up any dissolved



Home-made furnace devised for smelting cyanide precipitate at Nangodi. Diagrammatic

values left behind by the second leach, and then pumped to storage. If necessary, another water wash can be applied if storage capacity and time permit.

The amounts of solutions used have to be watched closely, else one may find an excessive accumulation of solution that carries values and no available storage space, and down the drain it has to go. Ratio of ore to solution will vary from 1:1 to 1:2, according to storage capacity and the operator's findings. Several small washes will generally be found more efficient than one large wash. The upward percolation advocated in this system of leaching was adopted after several trials, giving a slightly better extraction than simple downward leaching and also some saving in time. It has also another advantage: When treating slimy sands, downward-leaching tends to compress the charge, retarding the percolation rate, and makes subsequent washes long-drawn-out. Upward percolation keeps the sands loose and drives the air before it.

No elaborate methods are necessary for making up the cyanide solution. Here we simply put the calculated amount of cyanide in a perforated iron drum, immerse it in the solution tank, and blow in air until dissolved. If the air pipeline is allowed to extend, say a foot, in a horizontal plane inside the tank, the air will then impart a swirling motion to the solution, insuring uniformity and rapidity in dissolving.

The whole cycle of leaching and washing operations can be summarized as follows:

	Hours
Filling the sand tank	15 to 18
Running in the first leach and overflowing the contained moisture	8
Leaching period	18
Second leach overflowing first to precipitation	32
Applying water wash, soaking, and pumping off	16
Emptying	10
Total 4½ days (roughly)	

If question arises as to the relative time for filling and emptying, it should be noted that the sand is brought to the tank in trucks, dumped in, and shoveled into place by native "boys." In emptying they simply heave the sand out, and it is trucked away at leisure.

The cocoanut matting used for filtering should be periodically taken out and cleaned. In time it becomes clogged with fine material.

Clarification—For efficient precipitation the pregnant solution should be clear; otherwise the zinc shavings (or dust) become coated with slime, and this interferes with their function. The slime, moreover, increases the amount of material to be smelted subsequently and often results in a low-grade bullion. If a press is not available, the solution can be clarified conveniently in a sand filter tank. The clarifier in use here is made from old oil drums, which have had their ends knocked out and have been split down the center and beaten out flat, finally being welded to form the tank. Five inches of barren ore is then laid over the tank bottom, covered with old cocoa sacks, and then again is overlaid with 3 in. of sand. This clarifier costs practically nothing and is as efficient as any put on the market. Still another idea when zinc shavings are used, as in the case with most "bush" plants, is to leave the first compartment free and fill with, say, cotton waste for a clarifying medium.

Deoxidation—Oxygen being essential for dissolving the gold, it is correspondingly not wanted in the solution to be precipitated. In plants using the Merrill-Crowe system, this point is automatically attended to, but the small operator using zinc boxes has to devise his own method. Here we use iron turnings contained in two oil drums connected in series. The solution passes through the turnings and thence to the zinc box. In time the iron becomes oxidized and has to be renewed. The test with pyrogallic acid is available for determining the point when the turnings are no longer useful. This is a rapid method for determining the amount of oxygen in solution, and with its aid a systematic study of the oxygen content of solutions at various stages in the process may well be made, leading to improvements in extraction and precipitation. Three or four clear glass stoppered bottles of about a pint capacity, a solution of caustic soda (80 grams per liter), and some pyrogallic acid are all that is needed. A saturated solution of air in water is made by half filling a large bottle with distilled (or rain) water, shaking it well for some minutes, pouring into one of the clear bottles, adding 0.10 grams of pyrogallic acid, running in 1 cc. of the caustic solution, closing with the stopper (to exclude air bubbles), and shaking until the pyrogallic crystals are dissolved. This serves as the standard. Any solution may now be tested by immersing one of the clear bottles in it, allowing it to fill, and stoppering it while under the solution. Withdraw the bottle, take out the stopper, add the same amounts of pyrogallic acid and caustic solution as have been added to the standard, replace the stopper, shake, and compare with the standard. If no oxygen is present, the sample will be practically colorless; otherwise it will be of a brown color like that of the standard. The method is usually made quantitative, but all the operator needs to know is whether enough oxygen is present in the leaching solutions and whether it is absent in the solution going to precipitation.

Precipitation—For the small operator using zinc shavings, precipitation probably causes as many headaches as getting the values into solution, for the number of side reactions that can take place in the box is astounding (especially when leaching ores containing base metals). Usually, but not always, these reactions march side by side with high tail values. By way of illustration, recently, in the course of leaching pyritic sands, I have had much trouble with excessive "frothing" in the zinc box, with fluctuating tail values. The froth is due to a copious evolution of hydrogen, the zinc being rapidly dissolved. I have managed to bring it under some measure of control by increasing the lime added to the sands and bypassing the deoxidation unit. There is no oxygen present in the solution coming from the sands, pointing, I should imagine, to the fact that the ferrous hydrate and ferrous sulphide formed from the iron pyrite present in the sand are absorbing all that is available.

In the zinc-box practice at Nangodi the zinc is packed in the usual crisscross fashion, the shavings having been wound into bundles 5 in. in diameter and 3 or 4 in. longer than the width of the compartments. Each end of a bundle is doubled over so that the length is approximately that

of the compartment. Especial attention is paid to the corners, for here channeling is most likely to occur. Extra care is exercised when filling the first two compartments, where the bulk of the gold is precipitated. During the month, as the zinc (especially in the first box) gradually dissolves in the cyanide and it becomes necessary to make good this loss, the general practice is followed of moving up the unconsumed zinc from the lower compartments to the upper ones, adding fresh metal only to the last one. Personally I never make good any loss of zinc in the first compartment after the middle of the month, this to insure the deposition of the maximum amount of gold with minimum zinc. Precipitation is necessarily greatest on its first contact with the shavings, and the less metal there is in the upper compartment the more concentrated the gold precipitate, thus easing and shortening the subsequent calcination, acid treatment, and smelting. Further, when the clean-up takes place, there is some saving in time, for the zinc in the first box is halfway down. When I commenced duties at Nangodi, always in the past having worked with a Merrill-Crowe plant, the clean-up and repacking of boxes used to drag on for two or three days of backaching labor and much expenditure of temper. Now it occupies two successive mornings. A disadvantage of zinc shavings, especially from the small worker's viewpoint, is that every month an amount of gold approximately one half to one month's output is carried forward in the boxes because of the gold adhering to the freshly added zinc. This carryover is a variable quantity, and for this reason the amount of gold calculated from the assays rarely agrees with the bullion actually cleaned up. My experience here is that for several months in succession there will be a "minus"; then a change will occur and several "plus's" will crop up.

A strong cyanide drip is maintained at the head of the zinc box as insurance against that troublesome deposit known as white precipitate. It will be observed occasionally that when this deposit makes its appearance, the cyanide strength of the solution passing through the box is lower than usual and when this is increased the trouble clears up. Unfortunately, it is not always so easy, for, in spite of varying the cyanide strength, altering the alkalinity, likewise the lead drip, renewing the deoxidation reagent, etc., this deposit has persisted and indeed threatened to become serious. The only remedy appears to be to have an emergency clean-up and renew the iron turnings (if this has not already been done). Contrary to statements in the textbooks, I have never had any trouble with white precipitate while leaching pyritic sands, and, at present, as a precaution against it, am adding pyritic sands to the white sands. The pregnant leaching solution leaving these pyritic sands contains practically no oxygen, and if oxygen is necessary to the formation of this white deposit, the reason is clear why no trouble is had from this direction when dealing with these black sands.

Trouble with Copper

Another disturbing factor has been copper. I first met with it when I had some slimes to deal with. I was getting rid of these slimes by mixing them with sands in the proportion of 5 of the latter to 1 of slime and had been treating them for about a fortnight when the box tails started rising. As it was within a day or two of clean-up, I thought maybe that the box had its quota of precious metal, especially as things seemed under control. When the clean-up was finished, a greenish stain was apparent on one of the iron vessels containing the gold precipitate. On testing for copper it was found in excess. The remedy in this case fortunately was easy, for the slimes were found to be copper-bearing and the proportion was cut down to 15 sand to 1 slime. There was a fair amount of copper still in the circuit solution, but an increase in the lead drip had a beneficial effect. The smelt that month was troublesome. I increased the strength of acid during the acid-treatment of the precipitate with the idea of dissolving out as much copper as possible, but without result. On smelting, frothing was so intense that it bubbled over the side of the crucible before anything could be done. When the bullion button was finally tripped out of the mold, the copper had formed a thick matte just above the gold and was so firmly attached that it could not be separated. On resmelting for casting into a bar the same thing happened, so it was sent to the refiners without further treatment.

The clean-up apparatus at Nangodi is of simplest character. We put the zinc shorts from the first two compartments into a wooden basket having a bottom of ⅛-in. wire mesh, immerse it in a small iron tank of water, and give it an up-and-down motion. All metal going through is collected, drained, and acid-treated; that remaining on the screen is repacked in the first compartment.

Acid Treatment—At Nangodi acid treatment is merely a question of economics, the cost of the acid being weighed against the saving in fuel oil (for smelting) and fluxes. In spite of the acid costing 1s. per pound, we use it when it is available (we have had some on order now for six months but so far have heard nothing of it), for it cuts down the bulk of the precipitate by roughly a third and a cleaner bullion is obtained. The treatment is performed in an enameled vessel, the sulphuric acid is made up to 15 percent H_2SO_4, and the precipitate added in small shovelfuls. Good ventilation is essential, as poisonous HCN and AsH_3 are given off. After this has stood overnight, the acid is siphoned off and the residue is washed with water until neutral. Generally, five washes are sufficient. The precipitate is then collected in cloth bags, which are hung up to drain. Calcination, in iron trays over wood fires for the purpose of drying and oxidation of the remaining zinc, and then smelting, follow (more of less) orthodox practice.

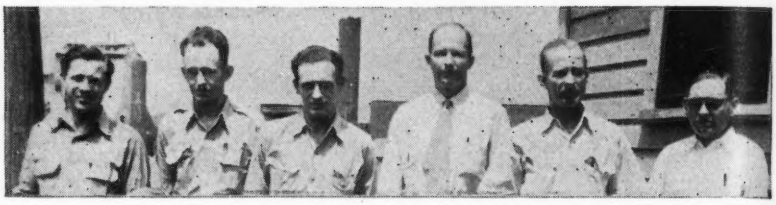
At one time the smelting took place in an old oil drum lined with firebrick and fired with fuel oil and air. Recently, however, we made some improvement. Perhaps the details of our home-made furnace may interest some readers. Two holes are dug in the ground, one (A) large enough to contain the smelting crucible, the other (B) deep enough to contain an oil burner on a short stand. Hole A is lined with firebrick and the other is cemented. A cast-iron lid (in two halves) is made for the smelting compartment. See cut opposite.

This furnace has the advantage over the original one, in that the operation of lifting the crucible out at the end of the smelt is rendered safe and easy with the aid of a pair of basket tongs. A 100-lb. charge can be run down in five to six hours, with about 25 gal. of fuel.

Slimes—Perhaps a word or two about treatment of slimes at Nangodi may be of interest, for we are disposing (in part) of these by leaching. It is really an adoption of a method in use in Rhodesia and is indeed "bush." Shallow leaching tanks, 30 by 25 by 2½ ft. in dimensions, made from old 45-gal. oil drums are used. These are made up by the method used for turning out the clarifiers already described, except that the tanks are square. The sun-dried slime is shoveled on top of the 3-in. layer of sand to a depth of 18 in., care being taken not to allow the native shovelers to tread on it once the slime is in the tank. Cyanide solution (0.05 percent) is applied and allowed to soak for two days. It then trickles off and is followed by two short water washes. With the pyritic slimes we are getting 50 percent extraction, the gold dissolves up to 65 to 70 percent, but owing to the thick sloppy mess that the slime eventually becomes, the soluble loss is high.

Tennessee Phosphate Field Sees Changes

Transport between mine and washer and flowsheet at latter are chiefly affected



John Norton, manager, International's Tennessee Phosphate Division, fourth from left. The others, left to right, are: E. G. Kraft, former general superintendent; W. F. Guenther, engineer; C. V. Harris, former division engineer, now flotation superintendent, Peace Valley plant, Florida; C. J. Schirmer, superintendent at Mt. Pleasant; and J. H. Hayes, chief mine clerk

Road machinery plays its part. A grader at the Wales plant preparing grading for runaround for switching cars to load from stock

OPERATING PRACTICE in mining and washing phosphate rock in the Mt. Pleasant district, in central Tennessee, has passed through successive stages of improvement[1] since the deposits of that region were first worked in 1898. Thus, as in other mining districts where the best ore has been taken first,[2] operators here as time went on have been able to mine material of poorer and poorer grade by adopting more efficient equipment, increasing the scale of the work, and bettering the recovery. The present trend toward a larger scale of operations is noticeable.

In part, such changes have been a gradual evolution. At times they have been more rapid, as in the last two years. The recent changes made by some of the companies have included the further adoption of trucks[3] in place of the long-used railroad transportation to carry the phosphate ore from mine to washer; the use of sluicing with or without scraping to get this ore from storage outside the plant into the plant; and, most recently, the employment of differential grinding in the washer.

The biggest problem in the Mt. Pleasant district has been that of transporting the phosphate ore to the washer. For the most part the operators have long depended on trains of dump cars drawn by dinky steam locomotives. This calls for a large investment. In considering whether or not to open a new deposit one must have regard for the tonnage it contains, for this must be sufficient to permit amortization of the money required for cars, locomotives, and expensive track grading before exhaustion. Years ago such large deposits were not uncommon. Today they are harder to find. There have been smaller deposits, however, sometimes of high-grade ore, but these could not profitably be touched save by contractors who would truck the ore to the washer purchasing it. A solution to this problem, in some cases at least, has been offered by the development of truck haulage in open-pit practice in the past few years. With its own trucks, it would seem, a mining company might work a number of scattered small deposits and bring the ore into its plant, this without an excessive investment.

Whatever may be the outlook in this direction in view of the current situation in respect to rubber and gasoline, one company—the International Minerals & Chemical Corp., formerly known as the International Agricultural Corp.—has turned to trucks to supplement its railroad dump-car system at its Mt. Pleasant unit. In this part of the district it has four pits that are supplying ore to its No. 6 washer. The phosphate ore is delivered by dump-car trains over the company's railroad, and by trucks over a 3-mile road built between mine and plant. The road is surfaced with mudballs from the log washers in the plant. Four 7-ton Autocar trucks have been provided. They are all gasoline-operated. These trucks are used where rail haulage is impracticable, as in deep pits. But if the haul is long, the locomotives are used.

As a reflection of its new interest in highway construction and maintenance the company has acquired some new equipment, including a road patrol and ditch grader, a sprinkler, and a bulldozer. The latter also serves for pushing ore from the stockpile into the sump. The road patrol also proved most useful on a recent occasion when it became necessary to install a new track switch calling for considerable grading.

The older steam draglines that were here in 1940 have been supplemented by a 54-B Bucyrus-Erie machine driven by a Buda diesel engine. This machine, which uses a 2½-cu.yd. bucket and a 90-ft. boom, has been added for stripping work. It is very mobile and can move ¼ mile to ½ mile per hour in contrast to the old steam stripper.

Washing at No. 6 plant proceeds on three shifts, on one of which the plant is fed by the dump cars, which are pulled one at a time by rope haulage to the top of a ramp where they are dumped and washed out, as has

[1] See "Phosphate—The Vital, Non-Metallic"—Part VI, *E.&M.J.* March, 1941.

[2] Today in the Tennessee field the best grade of phosphate rock made runs 72 percent B.P.L., compared with 78 and 80 percent once produced.

[3] Monsanto Chemical Co. has been using trucks for transport to its washer since it began mining phosphate in 1937. Its mining operations have been close to its plant.

been the method of feeding for many years. On the two remaining shifts the plant is fed by two monitors having 2-in. tips and using water at 115 lb. per sq.in. pressure which sluice the ore dumped in storage by the trucks into a sump from which an 8-in. Tampa dredge type pump delivers it to the washing plant. An additional stockpile near by is provided with another monitor and an 8-in. Tampa pump for use as may be considered necessary.

The flowsheet of the No. 6 plant shows some changes, which, though few, are interesting. A saving of 18-hp. has been achieved by substituting a double-deck Tyler screen for the trommel used in the old flowsheet. This new screen has the same feed as the old trommel—viz., the log washer discharge—and it makes three products: + 1 in.; − 1 in. + ⅜ in.; and − ⅜ in. Last year, a 6 ft. 6 in. by 6 ft. heavy-duty Eimco ball mill was being installed for differential grinding—a departure from previous practice in this plant. Equipped with a single-scoop feed and an 8,000-lb. load of 3-in. balls, this grinding mill now works on the + ⅜-in. products from the above-mentioned Tyler screen as feed and to separate flint, to disintegrate mud balls, and at the same time grind the coarse phosphate fine enough to go to the sand plant. On the discharge end of the ball mill there is attached a trommel 4 ft. long and 24 in. in diameter equipped with a ¼-in. screen. The oversize of this screen is elevated and, if low in flint, returned to the ball mill for further grinding, or if high in flint, sent to a storage bin and eventually discharged as waste. The trommel undersize is pumped to the sand-washing plant.

Another change that has been made is the elimination of the stationary screen in the old flowsheet by a 4x6-ft. Link-Belt vibrating screen. This screen takes the −⅜-in. product from the Tyler screen and makes a ¼-in. separation. The +¼-in. material is sent to the ball mill for grinding, and the −¼-in. material passes to the sand-washing plant. The 60-ft. thickener which had long been the bottleneck of the plant is now operating with a lowered specific gravity of the overflow, a change which has been accomplished not by the addition of more water but by the more efficient utilization of the other circuits in the flowsheet.

Thirty miles south of Mt. Pleasant, International has its No. 5 washer (Wales plant) and adjacent mines. For stripping there is one 54-B diesel dragline with a 90-ft. boom and a 2½-cu.yd. bucket. For loading there are two 52-B machines, each driven by a diesel engine and having a 2-cu.yd. bucket, the booms being respectively 80 and 85 ft. long. These draglines load and strip intermittently, there being more overburden at Wales than at the property in the Mt. Pleasant district.

Temporarily at least, International here is transferring its 4-cu.yd. dump-cars at No. 5 to other properties in the region and has adopted five 6-cu.yd., 7-ton Autocar trucks and four Chevrolet trucks with reinforced bodies for hauling from mine to No. 5 washer. Average truck haul is 4 miles round trip.

Here also the phosphate ore is being sluiced from storage into the plant. This practice of sluicing, both here and at Mt. Pleasant, provides a soaking for the ore that aids in subsequent separation of the slime. The water used would otherwise be added ahead of the log washers in the plant and the soaking would take place in the logs. At this plant 3,500 g.p.m. has been required for washing and 4,000 g.p.m. at Mt. Pleasant, under either system. At the former washer two monitors with 2-in. nozzles and water under 115-lb. pressure sluice the ore on to a perforated plate having 4-in. openings. The plus-4-in. material is mainly lime and is eliminated at this point as waste product. Any oversized lumps of phosphate ore remain on the plate grizzly until they are broken by the stream of high-pressure water and pass through the 4-in. openings. The undersize material runs to a sump from which a pump sends it to a ⅜-in. stationary screen. The oversize from this screen passes directly to a log washer, and the −⅜-in. material produced by it is sent to the fine-sand washing plant.

In general, the flowsheet at the No. 5 washer has been little changed as compared with that previously described.[1] Slightly higher specific gravities are carried here as compared to the Mt. Pleasant operation. In further comparison, the fine material up to 200 mesh here is sufficiently high in B.P.L. to save, control being effected by analyzing the next larger screen size; whereas at the No. 6 plant anything finer than 150 mesh is too low in phosphate content to warrant saving it.

In Hickman County, 30 miles northwest of the Mt. Pleasant district, International has recently acquired by purchase additional important reserves of phosphate rock, thus making its future in the Tennessee field more secure. Equipment is being installed for operations starting on a small scale which are expected eventually to become important.

In charge of International's Tennessee Phosphate Division is John V. S. Norton, manager. C. J. Schirmer, whose previous experience has been in South America and in the Southwest, is superintendent at Mt. Pleasant. Allan J. Hahn, also with South American experience, is superintendent at the Wales operation. C. V. Harris, until recently Division engineer, has been transferred to Florida, where he is in charge of flotation at the company's new Peace Valley plant. Louis Ware, mining engineer, is president of International and Franklin Farley is vice president in charge of the company's phosphate operations, with offices in Chicago.

Virginia-Carolina's Phosphate Plant Remodeled

Aside from the matter of transport, the changes in operating practice that the Mt. Pleasant district has been witnessing are well demonstrated at the Arrow plant of the Virginia-Carolina Chemical Corp.'s Mining Division, as the Charleston Mining Co. has been known since July 1, 1942. In fact, this company has been the first here to adopt differential grinding on phosphate rock. Moreover, the management, deeming it desirable to use large volumes of water in washing phosphate, now brings its muck into the washer by scraping to a grizzly and sluicing it through. These changes were made in remodeling the plant in 1940 for the purpose of increasing its capacity and the recovery effected, in keeping with a projected enlargement of the scale of operation. To increase capacity and at the same time to permit handling muck of lower grade, greater storage space ahead of the washer was provided. The total square-foot settling area also was approximately doubled in keeping with the larger plant capacity. At this plant Esperanza-type drags are largely used for settling. Capacity of the sand flotation plant, built in 1934, was also increased. Considerable new equipment was installed in the course of making these changes.

This work was done without interrupting operations. Today the plant has twice the capacity, in terms of finished product, that it had in 1940 and four times that of 1930, in which year the present manager, W. S. Stringham, came on the job.

After studying truck haulage as a means of carrying the phosphate muck between its mines and plant, the management decided to stick to its railroad transport. For years, the company has been using trains of 4-cu.yd. dump cars drawn by steam dinky locomotives on 36-in. gage tracks. It has gone progressively to bigger, heavier engines and to hauling longer trains, as transportation needs in-

creased. Normally it used 18-ton engines. From these it passed to 21-ton and then to 25-ton locomotives, and should it buy new ones, it might go to still heavier units, according to Mr. Stringham. It is likewise laying heavier rail.

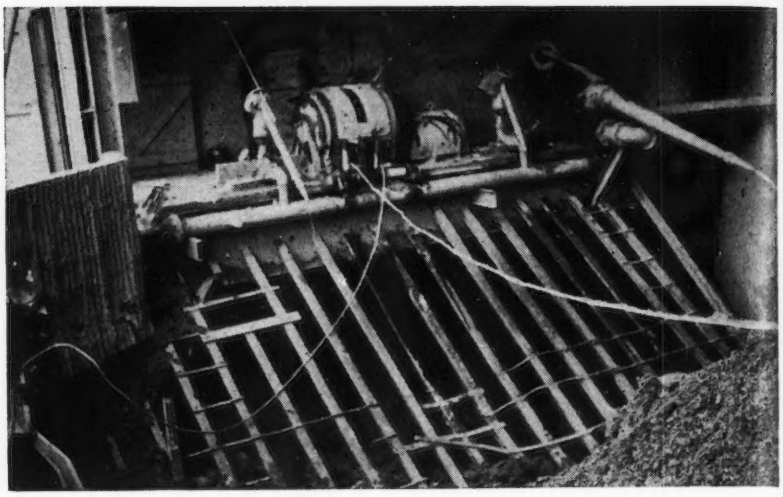
After close study of trucks and trucking in their up-to-date aspects it reached the conclusion, considering tonnage and distance, that its train haulage was cheaper for any job where the distance, one way, was over half a mile. Some of its hauls were as long as 4 miles. The weighted average ton-haul is 2¾ miles. This is the longest average haul in the district save that of one company. The latter has certain scattered mines, served by dump cars or contractors' trucks which carry the muck a certain distance to railroad cars, which, in turn, deliver it to the washing plant. To adopt trucks for such distances and for the tonnages now handled in the washer, these being as much as 80 tons per hour for 24 hours a day and averaging 1,800 tons per 24 hours after allowing for shut-downs, would have required too large an investment in trucks.

For stripping and mining the company has gone to the use of diesel-driven draglines. Two years ago it had a No. 38-A semi-diesel Marion unit having a 75-ft. boom and a 2-cu.yd. bucket. In addition, it now has a new diesel-driven 54B Bucyrus-Erie having an 85-ft. boom and a 2-cu.yd. bucket.

Old excavators include four steam-driven units—a Class 24 Bucyrus skid-and-roller type with a 115-ft. boom and a 3½-cu.yd. bucket; a track-mounted 150-B Bucyrus machine converted from shovel to dragline and having a 100-ft. boom and a 2-cu.yd. bucket; and two caterpillar-mounted 50-B Bucyrus draglines, each with a 60-ft. boom and a 1½-cu.yd. bucket. In addition there is a P.&H. gasoline-driven caterpillar-mounted machine with a 50-ft. boom and a 1½-cu.yd. bucket.

At present, when some difficulty might be experienced in getting parts for the new diesel-driven units, the existence of these steam machines is a source of satisfaction to the management, inasmuch as they can easily be repaired if necessary without need of special-steel parts.

Matrix delivered to the washer is now discharged by the dump cars from a trestle running over a storage bin of 2,500 tons' capacity. This is divided into two parts, one for high-grade and the other for low-grade. From the open end of the bin the muck is dragged directly on to a grizzly having 18-in. spacing by a scraper operated by an electric hoist. Scraping is aided by sluicing with



Phosphate muck from the feed bin is dragged to the grizzly at the Virginia-Carolina washer (scraper in lower left). The material after passing through goes to the scrubber

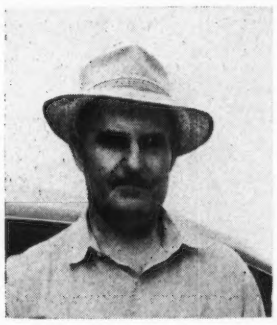
water under 110-lb. pressure supplied by a monitor and mounted over the grizzly. Water supplied amounts to 1,500 g.p.m.

After passing through the grizzly the matrix is scrubbed. Two scrubbers, each a steel cylinder with flights on the inside, are provided. One of these served the washer before it was remodeled and is 5½x40 ft. with a double (concentric) trommel built on the end, the two screens having 1-in. and ⅜-in. holes respectively. The other, which is new, is 8x25 ft. and is mounted like a ball mill on trunnions. It is followed by two screens that give the same separation as those on the other scrubber.

The undersize from the foregoing is classified hydraulically at 20 mesh. The plus-20-mesh size, running about 25 percent P_2O_5, is stored for either ball-mill feed ahead of flotation or for nodulizing, likewise the +1-in. and the −1-in.+⅜-in. sizes. The minus-20-mesh sands containing the slimes are cleaned as follows:

They go first to two 30-ft. Denver hydroseparators, the overflow of which is held at 100 mesh so far as possible, by regulating the specific gravity. It is delivered to two 80-ft. thickeners which serve as hydroseparators. The overflow of the latter is −200 mesh and is the main part of the tailings. The underflow from the 80-ft. units is dewatered on a chain drag that is of unusual size, being 31 ft. wide and 85 ft. long. This product, running approximately 27.5 percent P_2O_5, is sent to wet storage.

The underflow of the 30-ft. hydroseparators is delivered by a diaphragm pump to two cells of cruciform agitators. Leaving the agitators, the pulp, after addition of fresh water, is de-



W. S. Stringham, division manager, Virginia-Carolina Chemical Co.

livered to two other 30-ft. thickeners. The overflow of these goes to the 80-ft. thickeners mentioned, and the underflow, after being agitated again and having fresh water added, goes to the big chain dewatering drag as a finished product. It runs about 31.5 percent P_2O_5.

Differential grinding is a prominent feature of the circuit just ahead of flotation. The material so treated is the plus-20-mesh rock previously stored. This is brought back from wet storage by a screw feed which can be regulated and which delivers it to the ball mill. The latter is an 8x6-ft. open-end overflow-type unit having wave-type liners and carrying 25,000 lb. of 3-in. steel balls and is run at 18½ r.p.m. The plus-20-mesh rock contains considerable free flint. It is pushed as rapidly as possible through the mill, a great deal of water being used. The phosphate is easily ground.

At the end of the mill and attached to it is a double trommel, the inside screen having ½-in. holes and the outside screen ⅜-in. holes. The oversize goes to a double-compartment vibrating conveyor, the plus ½-in. size going to one compartment and the minus ½-in. plus ⅜-in. size to the other. Either of these products can be returned to the mill or sent to waste, the decision depending on visual ex-

mination as to the amount of the silica.

This differential grinding is quite successful, a good rejection of the flint being made and only 11 percent of the total feed lost as slime.

The minus-$\frac{7}{8}$-in. undersize is split at 40 mesh. Oversize goes to a hydraulic sizer which returns all plus 40-mesh to the mill for regrinding. The minus-40-mesh material is dewatered on a 21x65-ft. drag to about 50 percent moisture, conditioned, and floated in 13 24-in. Denver Fahrenwald cells followed by two 10-ft. Southeast Missouri (modified Forrester) air machines.

This treatment is a soap flotation under P.R.C. license. The flotation concentrates are used to blend with the low-grade sands to make 33 percent P_2O_5.

Tails from flotation are sent to waste if low in P_2O_5. If high they are used in the nodulizing plant to regulate the silica.

Final tailings of the plant come from three sources: (1) Overflow from the 80-ft. thickeners, which is normally 100 percent −200 mesh; (2) silica reject from differential grinding; (3) sometimes the flotation tails. The bulk of the P_2O_5 in the tails would be in the big tonnage of −200 mesh material.

Plant operation is under laboratory control throughout. About 35,000 determinations per year are made, samples being run for P_2O_5, insoluble, iron, lime, and alumina. Many screen analyses are made.

A head sample is taken. It may vary widely, ranging usually from 17 to 23 percent P_2O_5.

Normal metallurgical recovery, taking the plant as a whole, is about 71 percent. Though this sounds low, it is a great improvement over the 44 percent 12 years ago. Further, there is considerable colloidal phosphate in the clays which is practically irrecoverable by mechanical means. This could be flocculated, but the product would contain only 10 to 12 percent P_2O_5.

Water requirements of the washer are about 3,500 g.p.m. At certain times of the year a shortage manifests itself. All water possible is recovered by settling. Nevertheless, much water is lost by evaporation. That which is spread out in the big mud ponds has a very high rate of evaporation. More water is lost by drying the products. About 700 to 800 g.p.m. make-up water is required.

Consideration is being given to the possibility of drilling for water. According to geological information, there is a water table at about 1,100 ft.

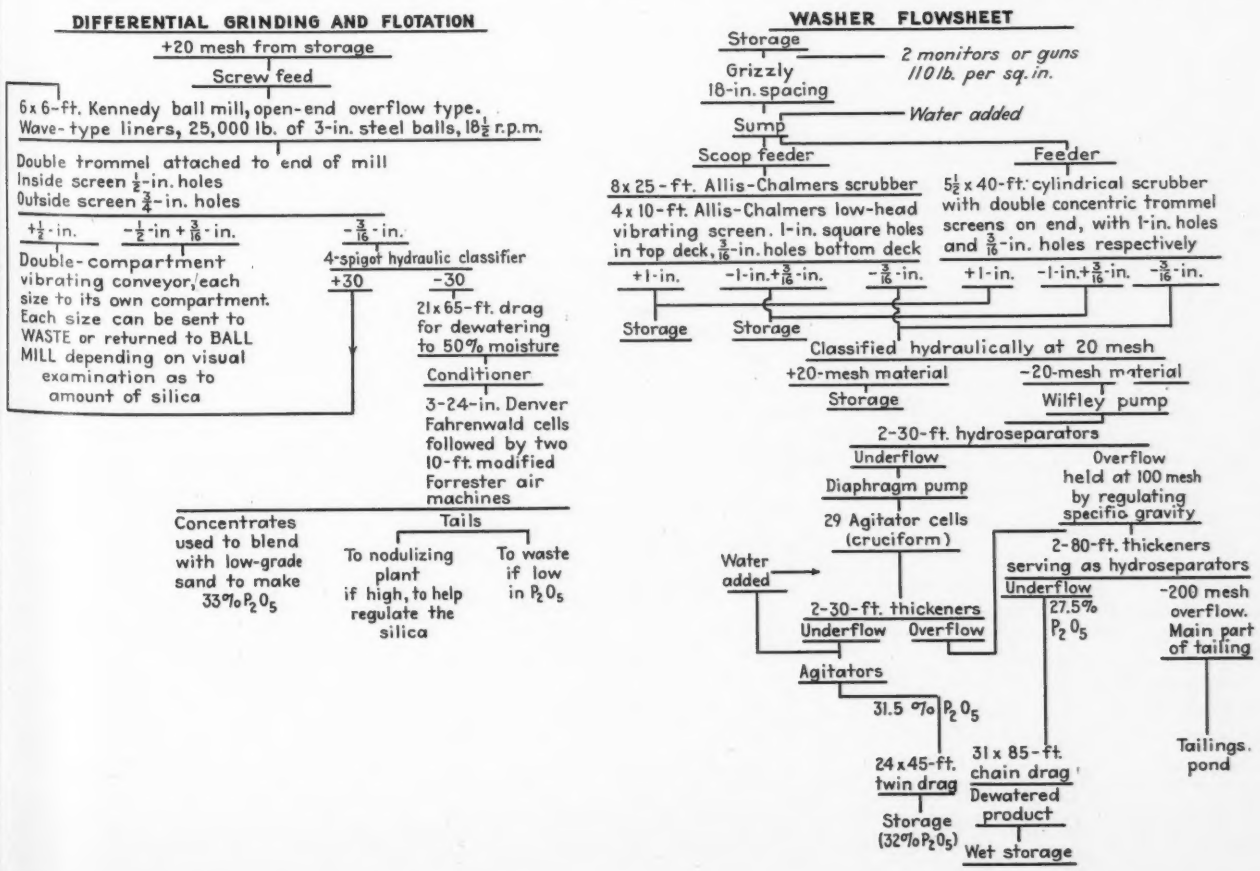
Plant products are first sent to wet storage, the capacity of which is 40,000 to 50,000 tons. For drying, four coal-fired rotary dryers are provided and there is dry storage room (under cover) for about 10,000 tons.

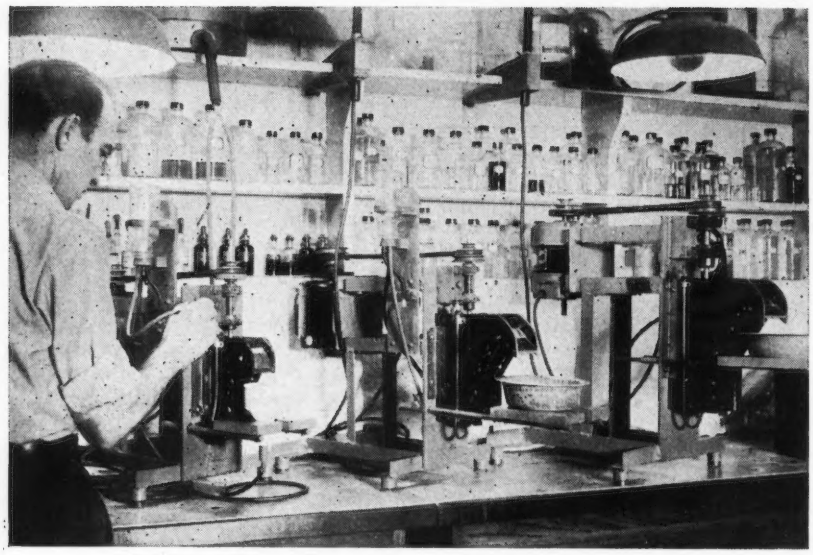
Where grinding for fertilizer is required, the rock is ground to 90 percent minus-80 mesh in a Fuller-Lehigh mill. Rock intended for direct application is ground to 95 percent minus-200 mesh through two Raymond five-roll high-side mills and one 5x10-ft. ball mill in closed circuit with a 12-ft. Raymond mechanical air separator. The product is bagged in a four-spout Bates bagger.

Nodulizing equipment is also provided in a separate plant, a nodulized material suitable for electric furnace feed being made as required. The equipment comprises two 8x125-ft. rotary kilns, each fired by western Kentucky coal from a Raymond bowl mill. Each kiln discharges into a $5\frac{1}{2}$x45-ft. rotary cooler. A 30-ft. boring bar is provided for each kiln to break up rings, which form easily. A crusher and an electric vibrating screen complete the equipment. The furnace feed may also be shipped wet to the user near by.

(To Be Concluded)

Flowsheet of Virginia-Carolina washing plant. At left is shown the relation of differential grinding to the other steps


DIFFERENTIAL GRINDING AND FLOTATION
+20 mesh from storage
Screw feed
6x6-ft. Kennedy ball mill, open-end overflow type. Wave-type liners, 25,000 lb. of 3-in. steel balls, 18½ r.p.m.
Double trommel attached to end of mill
Inside screen ½-in. holes
Outside screen ¾-in. holes
+½-in.
−½-in +3/16-in.
−3/16-in.
Double-compartment vibrating conveyor, each size to its own compartment. Each size can be sent to WASTE or returned to BALL MILL depending on visual examination as to amount of silica
4-spigot hydraulic classifier
+30
−30
21x65-ft. drag for dewatering to 50% moisture
Conditioner
3-24-in. Denver Fahrenwald cells followed by two 10-ft. modified Forrester air machines
Concentrates used to blend with low-grade sand to make 33% P2O5
Tails
To nodulizing plant if high, to help regulate the silica
To waste if low in P2O5
WASHER FLOWSHEET
Storage
2 monitors or guns 110 lb. per sq. in.
Grizzly 18-in. spacing
Water added
Sump
Scoop feeder
Feeder
8x25-ft. Allis-Chalmers scrubber
4x10-ft. Allis-Chalmers low-head vibrating screen. 1-in. square holes in top deck, 3/16-in. holes bottom deck
5½x40-ft. cylindrical scrubber with double concentric trommel screens on end, with 1-in. holes and 3/16-in. holes respectively
+1-in.
−1-in.+3/16-in.
−3/16-in.
+1-in.
−1-in.+3/16-in.
−3/16-in.
Storage
Storage
Classified hydraulically at 20 mesh
+20-mesh material
−20-mesh material
Storage
Wilfley pump
2-30-ft. hydroseparators
Underflow
Overflow held at 100 mesh by regulating specific gravity
Diaphragm pump
29 Agitator cells (cruciform)
2-80-ft. thickeners serving as hydroseparators
Water added
Underflow
27.5% P2O5
−200 mesh overflow. Main part of tailing
2-30-ft. thickeners
Underflow
Overflow
Agitators
31.5 % P2O5
Tailings pond
24x45-ft. twin drag
31x85-ft. chain drag
Dewatered product
Storage (32% P2O5)
Wet storage



Completed 100-, 250-, and 500-g. cells in the laboratory.

An Improved Flotation Test Cell

Bureau of Mines develops new unit and devises technique for batch testing

J. Bruce Clemmer — *Metallurgist*
B. H. Clemmons — *Assistant Chemical Engineer*
Bureau of Mines Southern Experiment Station
Tuscaloosa, Ala.

LABORATORY FLOTATION CELLS of the mechanical agitation type, patterned after large commercial units, are available in capacities ranging from 500 to more than 4,000-g. For many purposes, however, a smaller cell would constitute a useful addition to the laboratory. Cells of 100- and 250-g. capacities are especially useful for recleaning lightweight froths from larger-scale batch operations and for comparative testing of reagents, particularly when trends only are sought or where a large number of tests must be made with minimum material.

Small mechanical agitation cells of 100- and 250-g. capacities have been in use at various laboratories of the Federal Bureau of Mines experiment stations for the past ten years. The first cells were similar to those described by Gates and Jacobson,[1] and later by Keiser[2] and Hansen[3]. These cells were used for several years but were never completely satisfactory. Subaëration cells with positive air control were desired, and the Minerals Separation type was finally selected because of simplicity of construction. The design was improved to give greater aëration and smoother operation, latest additions including an accessory device for filtering the flotation froth and returning the filtrate to the cell during the flotation run. Frequent requests for blueprints of the cell and assembly led us to believe that a description may interest others engaged in flotation testing. Latest improvements in design were worked out at the Southern Experiment Station of the Bureau of Mines, in cooperation with the University of Alabama.

To Gaines T. Adams, senior mechanic, and H. S. Hardman, junior mechanic, the writers wish to express sincere appreciation for the many helpful suggestions and assistance in designing and constructing the cells herewith described.

Choice of the material for all construction is one of individual preference. Cells of wood, galvanized iron, zinc, sheet iron, stainless steel, and various plastics, such as Bakelite and Lucite, have been used. Of these, Bakelite or Lucite cells are preferred and have given best service.

Dimensions of the 100-g. cell are given in Fig. 1 and the details of the stand in Fig. 2. The cell was made of transparent duPont Lucite, equipped with a Lucite grid and a glass air tube with stopcock. Brass angles attached the cell to the stand. The impeller assembly consists of a stainless-steel shaft and a four-blade impeller supported by Oilite bearings in pillow blocks attached to a piece of 3-in. channel iron. The lower bearing is protected from splash and dust by a felt ring inclosed in a ¾-in. copper water-pipe cap drilled to accommodate the shaft and attached to the shoulder of the lower pillow block by a small setscrew. The assembly is attached to the stand with a bolt and wing nut. A slotted opening permits vertical adjustment of the impeller for proper aëration. The motor has both vertical and horizontal adjustment.

The Lucite cell, though made primarily for laboratory demonstration purposes, was easily fabricated by using Lucite cement, a solution of Lucite in acetone, which gives a strong, watertight joint. Assembly screws and tiebolts are not necessary, because the cement alone will give a sufficiently rigid cell if the important edges are finished in a milling machine rather than by hand. Properly made, the Lucite joint is as strong as the original sheet.

The glass air tube is offset for increased aëration, and is held in place by a thin coat of duPont household cement. Roughing the surface of the tube with emery paper or with a dilute hydrofluoric acid etch gives a better bond. The small drain hole may be placed in any convenient position.

Made of either stainless steel or thin sheet Lucite, the grid should fit the cell snugly, and may be supported by small Lucite T's, cemented in position before the cell is assembled. The speed, size, shape, and position of the impeller, as well as the size and position of the grid and air inlet, influence the amount of air drawn into the cell. For the cell shown, the impeller should be run at 2,100 to 2,000 r.p.m. and adjusted vertically to give maximum aëration without pronounced surging in the cell. A position about halfway between the grid and bottom should give best aëration.

Several 100-g. cells have been made of Bakelite and other phenolic resins,

This report represents the results of cooperative work between the Bureau of Mines, U. S. Department of the Interior, and the University of Alabama. Published by permission of the Director, Bureau of Mines.

[1] Gates, J. F., and Jacobson, L. K.: "Development and Operation of a 50-g. Flotation Machine." *E.&M.J.*, Vol. 119, pp. 771–72 (1925).
[2] Keiser, H. D.: "New Laboratory Flotation Cell Developed at University of Utah." *E.&M.J.*, Vol. 126, p. 504 (1928).
[3] Hansen, M. S.: "Perfection and Use of the 50-g. Flotation Cell." *E.&M.J.*, Vol. 133, pp. 28–29 (1932).

which, for general purposes, are preferred to Lucite. The material is more resistant to abrasion and is practically inert to the common flotation reagents. Basic dimensions of the Bakelite cell are the same as those given in Fig. 1 for the Lucite cell, except that the sides and the front and back panels are extended an additional $\frac{3}{4}$ in. at the front and bottom to permit the use of tierods. The cell may be assembled with brass machine-screws set in drilled-and-tapped holes. For a good fit the front, back, and bottom panels should be milled, and duPont household cement may be applied to all joints to make them watertight.

If a 250- or 500-g. cell is desired, large-scale replicas of the smaller cell may be constructed. The inside dimensions of the 100-g. cell multiplied by 1.36 or 1.71 give the dimensions of the 250-g. and of the 500-g. cells respectively.

Ordinarily neglected in batch flotation testing is the influence of water removed in the froth. The customary procedure is to add fresh make-up water as required, but on certain ores this quantity may be rather large, and the entire behavior of the sample changed thereby. To minimize this factor, use has been made of an auxiliary device designated as a "semi-automatic filtrate return" that filters the froth as it is removed and returns the filtrate to the cell periodically. Details of the filtrate reservoir are given in Fig. 2 and the complete assembly is shown at the left in the photograph. Vacuum is supplied by a water-injector laboratory pump, and is applied to the Buchner funnel through the three-way stopcock and inverted bottle reservoir. A rapid-filtering qualitative filter paper, such as Whatman No. 1, is used. The froth is filtered and the filtrate collected in the reservoir. Turning the valve releases the vacuum, and the collected filtrate may be returned to the cell by gravity. A pinch clamp on the return line prevents short-circuiting of the vacuum system. The operation may be repeated as many times as necessary during a test.

The filtrate return has been particularly useful in determining the influence of pH or reagent concentration on recovery operations wherein make-up water should be held to a minimum. Use of the device reduces the water requirements considerably, and many tests have been made without any additional make-up. Comparative tests with and without the filtrate return indicate that frother and collector requirements often are considerably less when the return is used. This would be expected, as full efficiency of the frother or collector cannot be realized if part is carried over in the froth water and lost.

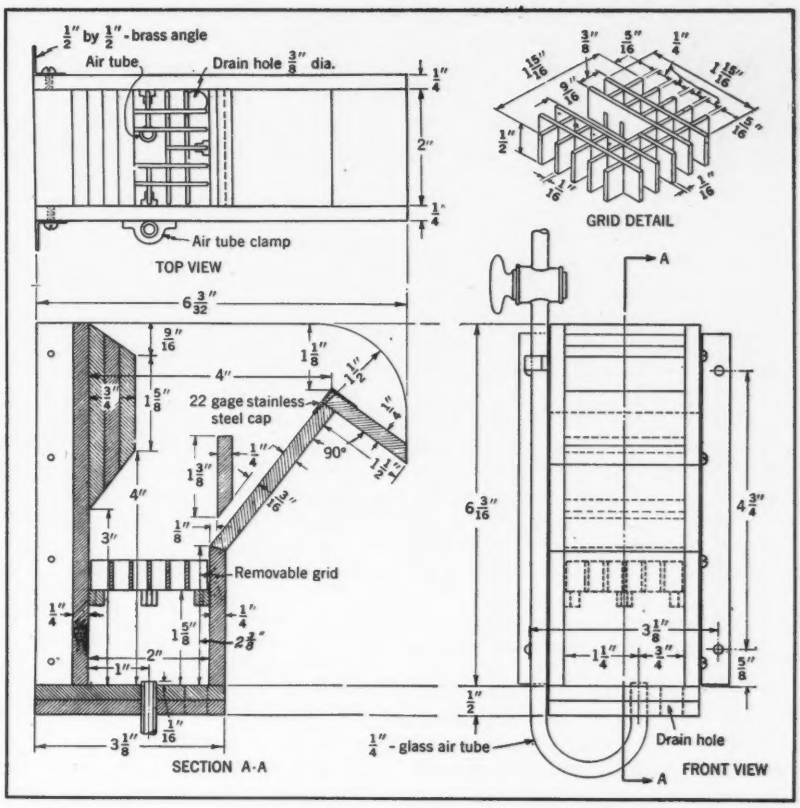


Fig. 1 . . . . Sub-aeration flotation cell, capacity, 100 g.

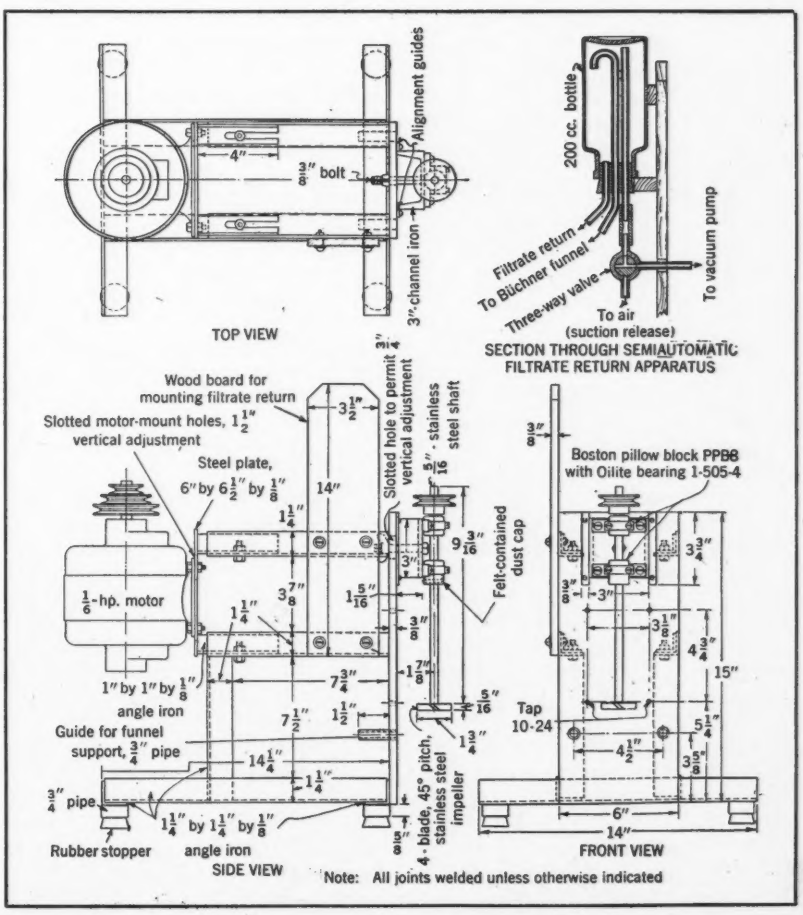

Alignment guides
$\frac{3}{8}$" bolt
3" channel iron
TOP VIEW
200 cc. bottle
Filtrate return
To Büchner funnel
Three-way valve
To vacuum pump
To air (suction release)
SECTION THROUGH SEMIAUTOMATIC FILTRATE RETURN APPARATUS
Wood board for mounting filtrate return
Slotted motor-mount holes, $1\frac{1}{2}$" vertical adjustment
Steel plate, 6" by $6\frac{1}{2}$" by $\frac{1}{8}$"
Slotted hole to permit vertical adjustment
$\frac{5}{16}$" - stainless steel shaft
Felt-contained dust cap
Boston pillow block PPB8 with Oilite bearing 1-505-4
$\frac{1}{6}$-hp. motor
1" by 1" by $\frac{1}{8}$" angle iron
Guide for funnel support, $\frac{3}{4}$" pipe
$\frac{3}{4}$" pipe
Rubber stopper
$1\frac{1}{4}$" by $1\frac{1}{4}$" by $\frac{1}{8}$" angle iron
4-blade, 45° pitch, stainless steel impeller
Tap 10-24
SIDE VIEW
FRONT VIEW
Note: All joints welded unless otherwise indicated

Fig. 2 . . . . Stand for 100-g. cell

Mine, Shop, and Plant

Wartime Substitutions

GETTING ALONG with what you have means "replace" or "substitute" when a needed material is scarce or lacking. While the German term *ersatz* means exactly "replacement" or "substitution," it has come to suggest to American minds the idea that the substituted material is inferior to the one replaced. Though this is often true, the exercise of one's ingenuity in devising substitutes may result in learning something new and advantageous. The replacement may be just as good or better.

A manufacturer lists the following replacements made in electrical goods: thin varnished cambric for varnished silk; felt for rubber in dustproof gaskets; silicon iron for nickel alloy in certain transformers; silicon bronze for monel metal in mercury-arc copper oxide rectifiers; and numerous other substitutes of less scarce metals for those of scant supply or which are no longer to be had.

Necessity being a stimulus to invention, the average mine shop or plant can doubtless point to some ingenious replacement of its own devising. Such information, with the results obtained or a cost comparison, or both, can well be passed along to other companies. *E.&M.J.* will open its columns to contributions on this subject. Anything that helps the operator is always welcome.

That Compressor

STANDING beside a compressor—one that is still new or has been maintained in good condition—one is fascinated by the clock-like precision with which it runs. Here is something truly beautiful, worth watching in this age of mechanization. Today it is more valuable than ever, hard to get, difficult to replace. Even an old one deserves attention. The Compressed Air Institute has just sent out a warning urging proper care of compressed-air plants to help the war effort. It says: "Compressors of all types have such an important part in practically every one of the major war programs, and their supply is so critical, that the War Production Board is allocating their purchase and production. They are an essential part of the equipment used in shipbuilding, ammunition, and explosives in all stages of manufacture, in the production of airplanes, tanks, guns, aviation gasoline, rubber and all similar supplies for the fighting forces. Huge volumes of compressed air and gases are used in the operation of blast furnaces, steel plants, the production of aluminum, and similar essential needs."

So, brother, watch that compressor! Whatever it is used for, it's important. Just as a diver is all through when his air line gets kinked or broken, the drills will stop underground when the compressor goes wrong, and anything else also that depends on the air it produces will lie down.

Conservation in Review

OUTSTANDING in the flood of clever literature issued by manufacturers to show users of their equipment how to make it last and give increased service is the smart 96-page brochure, "Wartime Conservation," prepared by Westinghouse to "help America save critical materials quickly." Informative and persuasive, its arguments have punch and its recommendations are in line with WPB's policies for conservation.

From generator to motor, the new bulletin advises full use of present equipment. "Make the most of what you've got." Operate it at capacity. Investigate ways of increasing its effective capacity. Buy standard equipment only. Avoid unnecessary accessories, unconventional designs, decorative devices—anything which requires special engineering, new tools, dies or tool steels. Don't overequip — buy what you need, no more. Operate with all possible care.

To get more out of the generating equipment that the user already has, the following is recommended:

Don't experiment. Consider each case on its own. Call on the maker for facts on apparatus characteristics or for advice. See if power factor can be raised by using capacitors; if the ambient temperature can be lowered; if old generators can be rewound—this after making sure that the prime mover will handle the greater load. Every time more output is gotten out of present equipment, critical materials that would be required in new equipment are saved.

As to ordering new equipment, the advice is: "Specify standard equipment. Use the smallest standard prime mover that will deliver the power wanted. *Eliminate the "pyramiding" of safety factors.* Omit unnecessary items from specifications. Use low-temperature cooling water, if this is possible, to permit the use of minimum-size coolers.

In selecting a proper distribution system, engineering advice is needed. In no field of electricity today is expert engineering of greater importance than here. A proper system is one that will provide adequate and reliable service, at the same time using the least amount of critical materials. A simple radial system or a primary selective network system may be the best one to use, depending on conditions.

As to switchgear, nameplate ratings represent the *maximum* equipment capacity. However it is possible to save, both on present equipment and on new. The manufacturer should be consulted. Buy nothing not needed or that can't be used.

The transformer is important. The whole power system depends on generation at comparatively low voltage, stepping up to high voltage for transmission, then down to low again for practical use. This is the transformer's job. Need for greater transformer capacity is more urgent than ever; also need for saving copper and steel of which transformers are made. Hence more kva. must be gotten from existing transformers.

So load them "to the gills," runs the advice, and do this by copper temperature rather than by nameplate rating. This will eliminate need for idle reserve capacity as a safety factor, at the same time permitting use, without hazard, of full thermal capacity. But it should be done only with engineering advice. Effective capacity of present transformers may be increased by employing air-blast cooling, or forced-oil circulation, or both of these expedients.

On repair jobs, critical materials can be saved by substituting greater flux-carrying material for silicon steel. Relocation of the transformers may help secure maximum benefits of capacity and positive protection, depending on conditions.

If new transformers are necessary, several things can be done: One is to select those that can be loaded by copper temperature. With such loading, transformers with high safety factors will not be needed in order to handle diversified loads with dangerous peaks.

Transformers that are 20 to 30 percent small can safely handle such loads as this.

As to motors, the company harks back to its "Calling All Horsepower" plan, introduced last September and aimed at the peace-time practice of "overmotoring" or using motors with substantial reserve safety factors. First, it says, find the facts accurately as to what horsepower is necessary for a given drive—this by test, by comparison, by accurate calculation, and by observation of actual operating conditions.

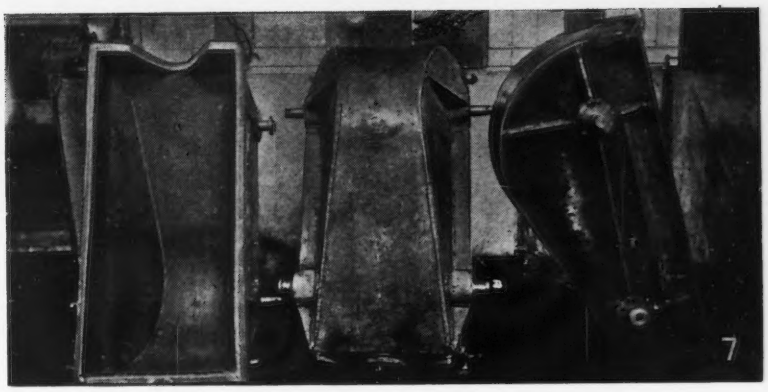
Then, take advantage of

1. Overload service factors built into the motor plus temperature conditions more favorable than those for which the motor was designed.
2. Favorable voltage and frequency condition.
3. Favorable operating conditions which permit use of standard, open, sleeve-bearing motors in place of fan-cooled or splashproof motors.
4. Conditions permitting use of higher speed motors (the faster the motor, the smaller its frame size and the less critical material required to make it).
5. Operating conditions that permit substitution of a.c. for d.c. motors. This will release d.c. motor production capacity, of which there is a shortage, and will save a substantial amount of copper.

Summing it up, motors should be selected on the basis of actual load, without additional safety factors. Up to 40 percent of the copper, steel, and aluminum used in motors can be saved by this program, the company asserts.

Fires Cut Production

MAINTENANCE of a plant and its equipment is so exactly the opposite of its destruction—by fire or other causes—that fire-prevention measures are in the same class with maintenance and should receive the attention they demand. Too often this attention is perfunctory, due perhaps, in some cases, to knowledge that there is insurance, but more likely to the fact that fire is something that has never happened yet to you and is not present until it suddenly occurs, in contrast to wear and tear on equipment, which are things that happen continuously before your eyes. Preventive measures, aside from installation of automatic protection where it can be used, include provision of equipment for fighting fire and the familiarizing of employees with it so they can use it effectively and without panic in emergency. Almost every issue of *E.&M.J.* contains a news item about the loss by fire of some mill or other plant. Every fire cuts production!



Spoon ladles used in pouring blister copper into molds

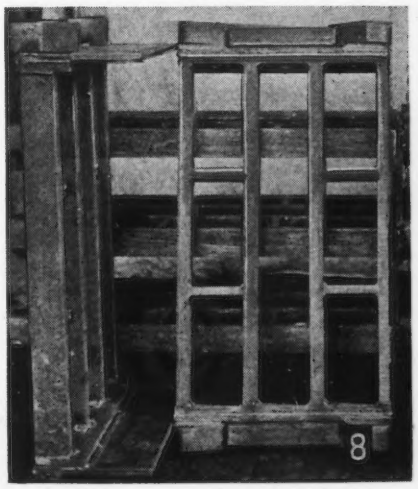
Arc Welding in a Copper Smelter—II

FOUR interesting applications of electric arc welding in the Garfield smelter of American Smelting & Refining Co. were described in these pages in the January, 1943, issue. The words were those of a prize-winning paper submitted by Gordon B. Forbes, mechanical superintendent of the plant, under the recent $200,000 Industrial Progress Award Program conducted by the James F. Lincoln Arc Welding Foundation. Equipment items covered were: a slag pot, electric motor end bells, bosh plates for blister-copper cooling sump, and a copper casting machine. Mr. Forbes' story continues:

5. Welded Ladle Used to Pour Copper Into Molds From Receiving Ladle—Here again is a typical replacement of cast iron with substantial savings. The cast-iron ladles would break in two after six to ten days of service, and if they were not watched closely as the crack lengthened and changed before breaking, the operator would be endangered.

Weight was kept to a minimum with well-placed ribs, as indicated in picture 7. The trunnions are forgings.

Some of the sinter machine pallets



Here again is a unit that was completely flame-cut from templates. The ladles shown have been in service 14 months and are still good. An average of 3½ cast-iron units were used per month. Comparative costs were: For the welded ladle—938 lb. at 0.035c., $32.83; labor, welding-rod forgings, etc., $37.52; total $70.35. For the cast ladle—Casting 1,650 lb. at 0.05c., $82; no labor or machining. Total $82. Saving per original welded unit, $11.65; net saving for the 14 months: 49 cast-iron units, $4,018; 3 welded units, $210.05; net saving, $3,807.95.

6. Sintering-Machine Pallets for Lead Ore Sintering—It had been the practice to use cast-iron pallets and still is in some lead smelters, but due to excessive breakage as they drop over the bull wheel to shake sinter off, it was decided to use cast steel. Here is one of the exceptions where cost was considered, and in considering cost, welded design was brought into the picture:

Estimates were made on the welded design and obtained from the local representative of Pacific Coast steel foundaries on cast-steel design. We found we could expect to make the welded construction at a net saving of $9.35 per pallet. Actual savings were $10.98 per pallet on the first 100 completed.

In designing this pallet for welded construction, it developed that standard bar sizes could be used, which simplified all flame-cutting, it being necessary to cut to length only all sections required. Picture 8 shows that the heavy bosses on the ends were flame-cut also, from 3½x5½-in. bar.

The pallets were assembled in a jig on the fitting-up floor, tack-welded, and delivered to welding floor, where they were placed in a specially built positioner, permitting all welds to be made in a down-hand position, this speeding up the welding and permitting use of ¼-in. electrode throughout. Jump welding, that is welding a little on one end and then a little on opposite end, held warpage to a minimum and permitted allowance of just

⅛ in. for machining stock where required.

Of the first 200 completed, now in service nearly two years, there has been no failure.

Following costs are of interest: For welded design—520 lb. material, $16.66; flame-cutting, $2.80; 50 lb. welding rod, $5; labor, $7.70. Total $31.16. Overhead at 15 percent, $4.66. Total cost, each, $35.82. For cast steel design—material, $46.80. Total $46.80. Net saving of welded design, $10.98. A net saving of $2,196 was effected on the first 200 pallets made and 300 more have since been made.

7. Bell Grinder Used to Grind Ore Samples—The sampling department desired a bell grinder larger than the 12-in. one in use. None being available, it was decided to build it. Welding was used to the fullest extent. A very compact machine was designed which would not have been possible had it been necessary to use castings other than the bowl and grinding bell, in which case some intricate pattern work would have been required. Picture 9.

From the design drawings it was estimated that it would cost $1,560 to build this machine using welded construction. Actual cost was $1,385.40.

The descriptions given are just a few concrete examples of what can be done with the electric arc on the heavier items required in most plants. We have consumed 75,000 lb. of welding rod per year for the last two years, using it for every conceivable thing that goes to keep a large copper smelter running.

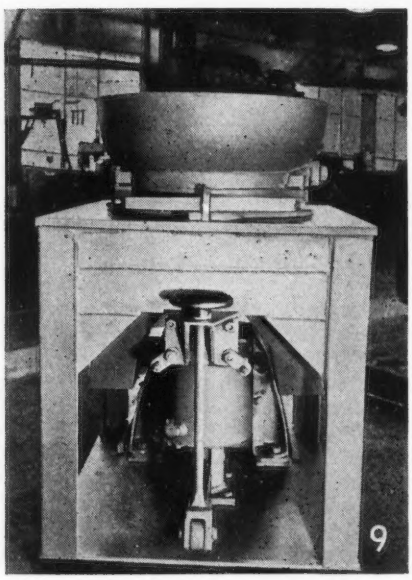
We make all of our steel gears up to what a No. 5 milling machine will handle, by rolling a rim of S.A.E. 1035 steel, a piece of plate for the web, and generally a piece of old shafting for a hub. The welded unit is then stress-relieved and normalized before machining. Depending on size, a new gear can be made within ten days.

Bearings of all kinds are made with a piece of shafting, a piece of I-beam for a base, and a brass bushing.

There are many plants that have untold feet of pipe of various lengths which, with the aid of the electric arc, can be made up into standard 20-ft. lengths again; odds and ends of angle iron, and I-beams, that can be welded into desired lengths. When welded by good operators, this is just as strong as parent metal.

Incidentally, during the last ten months our plant has not had a single piece of new plate, but, with the aid of the electric arc and second-hand plate obtained in junk yards, we have been able to keep at full production.

Another item of importance maintained with the electric arc is our cast-steel hot-metal ladles, of which we have 40, weighing over 15,000 lb. each. These ladles develop cracks and frequently have metal washed out due to impingement of hot metal on sides. In these cracks we have deposited as much as 1,200 lb. of metal to restore the ladle to service again. Experience has taught that it is necessary to stress-relieve before and after welding, as the ladles are very heavily stressed due to being first cold and then hot in handling hot metal, and being of a medium carbon steel, which requires normalizing after welding to obtain proper grain structure in and adjacent to the weld. These ladles cost approximately $2,000 each. Before the advent of the electric arc in the plant they were scrapped. They developed the defects which we now repair at an average cost of $250 per ladle.



End view of bell grinder

Crusher jaw plates are reclaimed, as are grinding roll cheek plates, which are of manganese steel. Clamshell buckets are maintained and electric locomotive tire flanges are built up (these tires are normalized before machining). All grizzlies are built up with a hard-surfacing rod and maintained with it thereafter.

Anyone contemplating use or increased use of the electric arc should select an aggressive, energetic young man who has demonstrated his practical ability as a welder, who has shown his aggressiveness by his attitude toward substituting welding for other types of construction, his ability to get along with men, and his salesmanship. Then send him on a trip visiting plants where welding is extensively used, have him observe the tools and methods used, the jigs and fixtures; have him talk to production men on how to control warpage and stress in welded structures; have him pick up points on stress-relieving, normalizing, etc., and the finer points in working with alloy steels, and observe the methods of fume control for operator protection.

This man will no doubt want one or more 400-amp. welding machines, a portable flame-cutter, one or more well-ventilated welding booths, pneumatic flux scalers, and the like, and herein lies the success of the whole plan.

Rod Economy

SIX POINTS to be kept in mind when using welding rod were made by H. O. Wertendarp, G.E. welding engineer, in a recent talk at Cleveland. They are:

1. Select the electrode of largest diameter and greatest length that can be applied successfully. This not only speeds up deposition rates of weld metal, but also results in a decided increase in the tonnage of electrode that can be extruded per day from existing facilities.

2. Joints to be welded must have good fit-up. Excessive gaps are prolific wasters of metal.

3. Use proper amperage for the job. Avoid excessive currents and long arcs. There is a current beyond which deposition rate is decreased and electrode consumption increased.

4. Don't bend electrodes except where absolutely necessary. Bent electrodes destroy electrode coating and result in excessive stub losses.

5. Produce true fillet welds having equal legs. This is a function of the proper type of electrode and welding technique.

6. Use each electrode down to the point where full-coating diameter ends.

Stocks of electrodes on hand should be used and stub ends converted as rapidly as possible. "Keep electrode off the floor," the speaker added.

When Drifting

CONSIDER THE JUMBO, how it works. Time and hard work saved with this equipment, in driving a heading large enough to justify the use of more than a single drill, are sufficient to cause surprise that it was not used more extensively in mine development in the past. Compared with the old laborious way of mounting the rock drills on columns and arms, with blocking and wedging, accompanied by a lot of heavy lifting, the use of the "jumbo" now on the market is simplicity itself. On a mounting built for it in the mine shop, it is rolled into the heading and braced against the back with the jacks that are a part of it, the drifters finally being cranked up to proper height, from which point they may be swung as desired from side to side. The jumbo has been in use for years, but it was usually custom-built or made in the shop.

Useful Operating Ideas

A Novel Pump-Priming Valve

RECENTLY, Empire Star Mines Co., Ltd., Grass Valley, Calif., was confronted with the task of providing some dependable priming arrangement for a large, automatically controlled centrifugal pump serving an underground dam, writes Phil Keast, shop foreman. As installed, the pump operates against a head of 906 ft.

Prior to the installation of the device here described, several priming units were tested, but all proved failures because the floats incorporated in their design did not withstand the pressure to which they were exposed. The problem was successfully solved by fitting the pump with the simple priming valve explained in the accompanying line drawings, which was evolved and made at the mine machine shop.

As will be seen in Fig. 1 it consists essentially of two standard pipe sleeves, a 2x1-in. pipe plug, a brass poppet valve, and a brass valve support with a turned-in valve seat. Pump installation details are shown in Fig. 2. Operation is relatively simple and entirely automatic. As the water behind the dam rises, it simultaneously fills the interior of the pump, thereby forcing all air out through the four ¼-in. holes a short distance above the valve seat. The poppet valve is closed by the pressure created after the pump impeller has reached a speed of about 50 r.p.m., and normal pump operation is assured immediately thereafter. Excess water in the pump chamber is discharged through the pipe assembly at the top of the priming valve. The device described has been in operation for many months and has required little or no maintenance service.

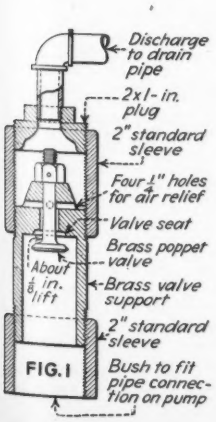


FIG. 1

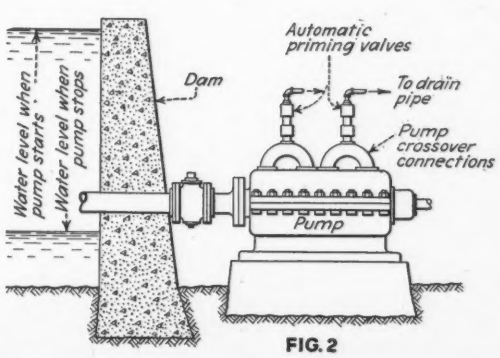
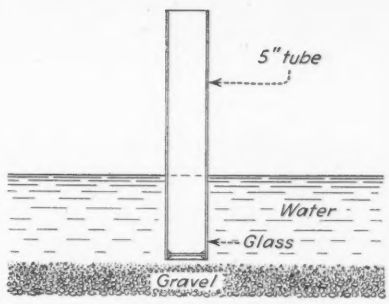


FIG. 2

Fig. 1 . . . Priming-value detail

Fig. 2 . . . Pump installation



Submarine Scope for Placer Work

DETAILS of an inexpensive yet effective tool that permits observation of bedrock in shallow streams are submitted by James F. Mullen, San Francisco, Calif. Operators of hydraulic placer mines have long found difficulty in cleaning bedrock, because discovery and removal of gold caught in submerged crevices may not be possible, and complete draining of bedrock is not always practicable. To enable close inspection of crevices, even in rough or muddy water, the scope shown in the accompanying diagram was devised.

A tin tube 5 in. in diameter and 2 ft. or more in length contains a glass plate cemented into one end. In use the tube is submerged as shown and the glass end brought as closely as possible to the stream bed. Gold particles can then be clearly seen in the muddiest water and can be easily recovered by tweezers or similar instruments. The scope is effective in water up to 3 ft. in depth.

Accidental Ground Ruins Motor Bearings

REPEATED FAILURE of the bearings on a 100-hp. slip-ring induction motor was a source of considerable annoyance to the staff of an Alaskan mining company, because no logical explanation could be found for the difficulty. Ralph E. MacKay reports that after only a few days' operation, the bearings would be completely broken down, the oil rings destroyed, and the journals pitted, all with no apparent defect mechanically or in lubrication. The mystery was cleared up, however, when one of the men reported seeing sparks in one of the bearings while the motor was operating, and with this clew the source of the trouble was located in a "dead" ground in one of the speed-controlling resistors. The mica bushing of the resistor had broken down and a ground connection was formed at this point, a circumstance which provided a shorter path from the grounded common point of the rotor windings than the regular path through the slip rings. Passage of the heavy secondary current through the shaft, the bearings, and the frame of the motor quickly broke down the bearings as fast as they were replaced. After a new mica bushing was installed on the resistor, no further trouble was encountered.

Mapping Inaccessible Spots in Mine Workings

SURVEYING INACCESSIBLE PLACES underground, as for example the walls of a sublevel stope where direct measurement is impossible, can be accomplished by a method suggested by Peter P. Ribotto and Ray G. Stott, engineers of Inland Steel Co. at the Morris mine, Ishpeming, Mich.

The procedure outlined below involves use of a side telescope in conjunction with the main telescope of the transit.

The instrument is set up at any convenient location and several points are selected on the wall to be mapped. Then a side telescope angle and a main telescope angle are turned from a known bearing to each of the points selected, using the main telescope backsight in each case. The distance from the instrument to the desired

point is equal to the distance between main and side telescopes divided by the tangent of the difference between the side telescope angle and the main telescope angle.

Maximum error possible with this method is 2.3 ft. in 50 ft., assuming accurate measurement of the angles to the nearest minute. Accuracy can be increased by plunging the telescope to bring the side telescope to the other side and repeating the procedure outlined in the foregoing, and by providing an extension to the telescope axis to increase the distance between the main and side telescopes.

Airplane Propeller For Mine Ventilation

WHILE DRIVING AN AIR RAISE for ventilation purposes, operators of Desert Silver, Inc., Nivloc, Nev., found it necessary to supply additional air for the main mine workings. Verne Haas, master mechanic, reports that the required ventilation was supplied by the use of a fan improvised from a small airplane propeller mounted on an electric motor. The propeller, a second-hand one obtained from a local airport, was the size ordinarily used with a 65-hp., 2,300-r.p.m. motor, but for its use in the mine, it was mounted on a 15-hp., 900 r.p.m. electric motor. The sleeve bearings on the motor were replaced, however, by a tapered roller thrust bearing.

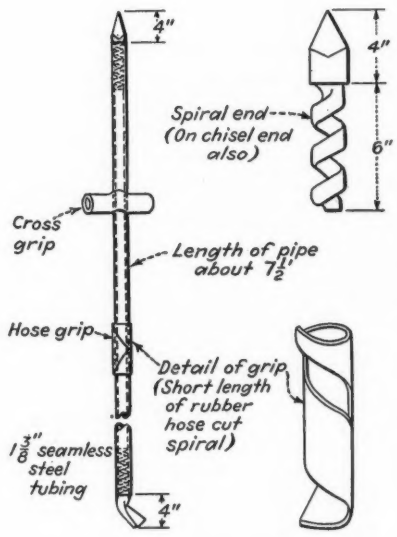
The fan was mounted in a drift which was bulkheaded off, leaving an opening the size of the propeller. Air was drawn down through a 600-ft. shaft, moved through 5,000 ft. of drifts and raises, and discharged through another shaft near the intake. Air moved in the drifts at about the speed of a man walking.

Operation of the fan was so satisfactory that it was run for a year even after the air raise was completed.

Light-Weight Pinch Bar

WITH LIGHT METALS such as aluminum and Duralumin not available for common use because of the war emergency, the pinch bar developed by the engineering research department of Anaconda Copper Mining Co., Butte, Mont., and shown in detail in the accompanying sketch, may be of interest to operators of mines where a large amount of rock testing work is carried out daily. The tool is light in weight and rigid, and has proved useful underground in the mines operated by the company in the Butte area.

As will be seen, use is made of a piece of $1\frac{3}{8}$-in. seamless steel tubing about $7\frac{1}{2}$ ft. long, with one end fitted with a chisel point and the other with a standard point. Old drill steel, shaped and hardened, is inserted into the heated tube ends, which are subsequently gently compressed to make a screw fit. Auxiliaries include a cross grip and a hand grip, both movable and made from short lengths of old rubber hose.



Scrap-Metal Reclamation

SHORTAGE OF METAL PARTS and fittings has aroused interest among mine operators in methods of reconditioning scrap materials. J. A. Bennett, Carlsbad, N. M., describes a simple apparatus for cleaning rusty bolts, chains, or other miscellaneous items recoverable from the average mine scrap pile.

A rotating drum of convenient size is mounted on rollers improvised from mine car wheels and is chain-driven by an electric motor. Material to be cleaned is charged into the drum together with a shovelful of sand or gravel, and the barrel is rotated until cleaning is complete. An air blast, piped to the barrel, assists in the final cleaning. Scrap materials were used throughout in constructing this apparatus.

Cement Lining for Mill Sand Pumps

TO SUBSTITUTE for scarce rubber or steel linings, Eric W. Johnson, mill superintendent of Island Mountain Mines Co., Ltd., Wells, B. C., recently experimented with cement as a lining material for a Wilfley pump. The plate on the pump side was removed and when the worn lining was taken out, pieces of $\frac{1}{2}$-in. square mesh 16-gage wire screen were cut to fit the inside walls of the pump case. With these pieces of screen as reinforcing material, a thick paste of cement was then applied to the case and to the plate, care being taken to reproduce as nearly as possible the contours of a new rubber lining.

Galvanized iron was used for the inside wall of a form for the main part of the case; and for the plate, galvanized iron was used for the outer part of the form, and a bucket for the inner wall. Cement was mixed as follows: $\frac{1}{2}$ cement, $\frac{1}{4}$ silica sand, $\frac{1}{4}$ washed gravel, $-3+10$ mesh in size, and, after applying, the mixture was allowed to set for a day before the forms were removed. When the parts of the case were fitted together, excess cement was scraped away and fresh cement was added to seal the joint. The lining was then allowed to set for 28 days before the pump was put into use. On examination after $2\frac{1}{2}$ months' service, very little sign of wear was found in the cement lining and no grooves had been worn despite the passage of 10,746 dry tons of ore through the pump during that period.

Handling Clay In Crushers

AT MILLING PLANTS where clayey material is received for treatment, trouble is frequently experienced in the crushing department. Apart from actual shutdowns due to choking of the crusher, extra labor sometimes is required to work the clayey material through the crusher. At cement mills the difficulty is partly overcome by sprinkling fine dry mix in the throat of the crusher before the clayey rock is fed. This prevents sticking upon the same principle that prevents dough from sticking when it is coated with dry flour. Fine tailings will answer the purpose in mill crushing plants.

A Use for Worn Jaw Crusher Plates

MANGANESE STEEL jaw-crusher plates which have worn so badly that they have no further use in the crusher will still give excellent service as ball-mill scoop tips, according to R. M. Gammell of Tucson, Ariz. It is a simple matter, he says, to cut the discarded plate into pieces of the proper size, which can then be welded or riveted to the scoop, and his experience has been that these improvised tips last as long as the standard tips supplied for this service.

Personal Items

W. G. Norrie-Loewenthal is in charge of the renewed development of the Silver Standard mine, near Hazelton, B. C.

J. C. Davey has been appointed consulting mining engineer for the government of Venezuela.

Ronald V. Hopper, formerly manager of the Surf Inlet gold mine, is residing at the Ritz Apartments, Vancouver.

Hans Lundberg, geophysicist, has returned to Canada after examining cryolite deposits in Greenland.

A. R. Crozier has been appointed mines assessor for the Province of Quebec. He succeeds the late A. C. Young.

Ernest L. Ohle, Jr., geologist for American Zinc Co., has been transferred from Batesville, Ark., to Joplin, Mo.

Gordon F. MacDonnell will represent Canada in Washington on the Combined Copper Committee, recently formed.

Norman F. Parkinson has been elected head of the Ontario Mining Association. He was formerly associated with Ventures, Ltd.

H. C. Fulton, of Duluth, Minn., has been elected president of the Cuyuna Fee Mining Co. He succeeds the late John Long of Cloquet, Minn.

S. S. Sullivan, a mining engineer recently employed on the Mesabi range in Minnesota, has removed to Little Rock, Ark.

J. W. deB. Farris has been elected a director of Hedley Mascot Gold Mines, Ltd., Hedley, B. C., succeeding his brother, **Chief Justice Wendell B. Farris,** resigned.

Donald A. Mackay, who was works manager for the Eastern Smelting Co., Ltd., at Penang, Malaya, prior to the Japanese invasion, is now in Melbourne, Australia.

Quenton L. Brewer has succeeded **Bruce McDonell** as head of the California Bureau of War Materials Production, 304 State Office Building, Sacramento, Calif.

Robert B. Gayer, recently on the staff of the Granby Consolidated at Copper Mountain, has been appointed mine superintendent at the Tyee project by Twin "J" Mines, Ltd.

A. W. Frolli, until recently manager of the Yellow Aster mine, operated by Anglo-American Mining Corp., Ltd., at Randsburg, Calif., is now at Silver City, N. M.

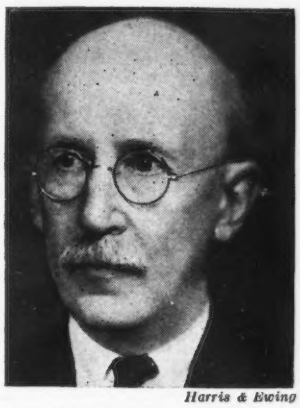
Clyde T. Harvey, formerly superintendent for Adelaide-Crown mine, near Golconda, Nev., has joined the staff of Getchell Mine, Inc., near Red House, Nev.

Robert A. Elliott has been elected president of the Association of Professional Engineers of the Province of Ontario for 1943. He is general manager for the Deloro Smelting & Refining Co.

Rudolph C. Savory was recently appointed chairman of Kinta Tin Mines, Ltd., Tangong Tin Dredging, Ltd., and Idris Hydraulic Tin, Ltd., succeeding **F. E. Mair.**

Erle V. Daveler has been elected a vice president of American Zinc, Lead & Smelting Co. He will be located at the New York offices of the company at 420 Lexington Ave.

Dr. Walter C. Mendenhall, Director of the U. S. Geological Survey, retired from office on Feb. 27 after having served the Survey more than 48 years. During this period he worked in four



Harris & Ewing

DR. WALTER C. MENDENHALL

of the Survey's five branches, was head of two of them, and finally became Director in 1931. His assignments took him into nearly all of the States and into Alaska and the Hawaiian Islands. **Dr. Julian D. Sears,** now administrative geologist, succeeds him as Acting Director. Appreciative comment on the career and achievements of Dr. Mendenhall is presented on page 48 of this issue of *E.&M.J.*

Earl S. Mollard has been appointed superintendent of iron mines of Butler Brothers on the Mesabi. **Clair E. McManus** succeeds Mr. Mollard as superintendent for the company on the Cuyuna range.

Walter T. Lewiecki, after having served as assistant geologist for Kerr-Addison Gold Mines, Ltd., of Virginiatown, Ont., for the past four years, has joined the staff of the U. S. Bureau of Mines.

Frank W. R. Godden, who was recently general manager of Bulolo Gold Dredging, Ltd., New Guinea, and returned from there to Mount Isa Mines, Ltd., Queensland, is now on the administrative staff of the Ministry of Munitions.

E. R. Bennett, superintendent of the Pennsylvania gold mine, in Browns Valley, Calif., operated by Empire Star Mines Co., Ltd., has gone to Washington, D. C., where he will assist the chief of facilities and construction for WPB.

F. S. Mulock, vice president and general manager of Western operations for the United States Smelting, Refining & Mining Co., has been elected president of the Utah Metal Mines Operators Association.

J. J. Craig, metallurgist, has joined the staff of the Republic Steel Corp. He will specialize in spong-iron investigation. Mr. Craig was formerly with the Mines Experiment Station of the University of Minnesota, at Minneapolis.

Howard McLeod is in charge of the new shaft being sunk at Ahmeek, Mich., for Calumet & Hecla Consolidated Copper Co. He was formerly a mine captain at Ravenna-Prickett iron mine at Crystal Falls, Mich.

Thomas R. Vaughan has been elected assistant secretary of Freeport Sulphur Co. He also holds the same position with the Cuban-American Manganese Corp. and the Nicaro Nickel Co., subsidiaries of Freeport Sulphur.

P. R. Bradley, Jr., has been elected president of the Mother Lode Mining Association. Other officers appointed include **L. A. Norman,** vice president, and **Leslie Grooms,** secretary. **John A. Burgess, Alex F. Ross,** and **Leon Banks** are directors.

John Carter Anderson, consulting mining engineer, having wound up the affairs of Warner Clark placer, near Angels Camp, Calif., which he was operating until the WPB closing order, has returned to his office, 453 Pacific Electric Building, Los Angeles.

Arthur D. Storke will relinquish the offices of chairman and managing director of Rhodesian Selection Trust, Ltd., Roan Antelope Copper Mines, Ltd., and Mufulira Copper Mines, Ltd., on April 1, at the same time becoming consulting engineer to these companies.

R. L. Beattie has become vice president and general manager of Canadian operations of the International Nickel Co. of Canada, succeeding **Donald MacAskill.** Mr. Beattie, until his recent appointment, had been assistant general manager and assistant vice president.

William J. Hosking has been elected president of the Western Quebec Mine Managers Association and chairman of the Quebec branch of the Canadian Institute of Mining and Metallurgy. Mr. Hosking is manager of McWatters Gold Mines, operating a property near Noranda, Que.

Dr. Harold Moore, C.B.E., a distinguished British metallurgist, has been awarded the London Institute of Metals medal for outstanding services to nonferrous metallurgy. The medal is offered to the Institute by Mond Nickel Co. and is of pure platinum. Dr. Moore is a Fellow of the Institute, of which he was president in 1934-36.

E. N. Pennebaker, geologist for the Consolidated Coppermines Corp., has returned to the Kimberly, Nev., copper mines from Cuba, where he has been

engaged in examination work during recent months for the American Metal Co., Ltd., large owner of Consolidated Coppermines shares.

Endicott R. Lovell, of Calumet, Mich., general manager and a member of the board of Calumet & Hecla Consolidated Copper Co., has been elected a vice president of the company.

Hale B. Soyster, of Chevy Chase, Md., has been appointed chief of the Conservation Branch of the U. S. Geological Survey, to succeed the late Herman Stabler. Mr. Soyster was educated in California, receiving the degree of bachelor in geology from the University of California in 1922.

W. H. S. McFarland, general manager of Yukon Consolidated Gold Corp., Ltd., is spending the winter in Vancouver and Seattle. **Charles E. McLeod,** formerly resident director of the company in the Yukon, has succeeded **G. R. F. Troop** as secretary-treasurer, with offices at 1919 Marine Building, Vancouver.

John E. Bowenkamp, mine exploration engineer and geologist for Wellington Investments, Ltd., the principal office of which is in Medellin, Colombia, has been employed during the past six months in the search for strategic metal-mining properties in Peru. His address is Apartado Aereo 817, Medellin, Colombia.

Allen P. Rogers, general repairman for Inspiration Consolidated Copper Co., Inspiration, Ariz., has received honorable mention from the War Production Board, for a constructive operating suggestion involving the use of leaded rods on posts in leaching tanks. This suggestion was forwarded to War Production Board Drive headquarters in Washington by the local labor-management committee.

Thomas L. Wells, editor of *The Explosives Engineer*, has been given a leave of absence to join the United States Marine Corps as a volunteer specialist. He has received a commission as first lieutenant. Mr. Wells, a graduate of Harvard and of the Colorado School of Mines, has had extensive mining experience in the United States, Canada, and Latin America.

Alphonse F. Brosky has been appointed chief of the New Program Section of the Mining Equipment Division of the Office of War Information of the War Production Board. Mr. Brosky, who was graduated as a mining engineer from Carnegie Institute of Technology, was for many years on the editorial staff of *Coal Age* and for four years with the Jeffrey Manufacturing Co., Columbus, Ohio.

Ray L. Hallows, of Joplin, for several years manager of the Eagle-Picher Galena smelter, became chief smelter metallurgist for the company, with headquarters at the Joplin offices of the company, at the beginning of this year. He succeeded **B. M. O'Harra,** who accepted a position at the close of last year at the Barber, N. J., refining plant of the American Smelting & Refining Co. Mr. Hallows was succeeded at the Galena plant by **Fred Clearman,** who had been assistant manager of the smelter a number of years.

Newton C. Marshall, mining engineer, has been elected a vice president of South American Gold & Platinum Co. He has been with the company since 1915 in various capacities, latterly as chief engineer, assistant manager, and manager, which last-named position he still holds.

NEWTON C. MARSHALL

OBITUARY

Harold O. Bosworth, president of the Denver Fire Clay Co., Denver, Colo., died Jan. 31, 1943.

F. A. Richards, retired mining engineer, died in San Francisco, on Dec. 17, 1942, aged 59.

Frank J. Eager, superintendent of Frood mine of International Nickel Co., died on Feb. 27 at the age of 65.

Donald MacAskill, who recently retired from his post as vice president of International Nickel Co. of Canada, died in Toronto on Jan. 23 at the age of 65.

Philip Dowd, superintendent of the Grass Valley Boundary mine, Nevada City, Calif., died on Jan. 25 at the age of 67.

Dr. John O. Downey, chemist, metallurgist, and geologist, and latterly economist on the staff of General Motors Corp., died on Feb. 2 in New York City.

The Hon. W. A. Gordon, Canadian mining engineer, formerly Minister of Mines and Minister of Labor and Immigration at Ottawa, Canada, died early in February at Toronto.

Bert F. Crandall, mining engineer, well known in Northern mining circles, died in Sudbury, Ont., on Feb. 6. He was 44. He had been in charge of the Frood pit of International Nickel since 1940.

Stephen A. Ionides, consulting engineer of Denver, Colo., who had recently been employed in a confidential capacity with the Signal Corps of the U. S. A., died at Charlottesville, Va., on Jan. 28. He was 62.

Charley Keeley, the prospector who discovered the Keeley mine, in South Lorraine, in the Cobalt district of Ontario, died in his cabin near Kirkland Lake on Feb. 26. He was 78.

J. A. Gustafson, "Gus," 76, died early in January in Seattle. He went to Alaska in 1905, where he was engaged in the mining, mercantile, and banking business most of the remainder of his life. He was a native of Michigan.

Alexander R. Shepherd, long interested in mining in Mexico, California, and Nevada, and formerly in the federal service as a consultation expert in the income-tax department of the Internal Revenue Bureau, died at Alexandria, Va., on Feb. 25.

George E. Tucker, superintendent of the Canisteo mine, Coleraine, Minn., died on Feb. 7, at the age of 59. Mr. Tucker had been in charge of the shipping and grading of ore for the Cleveland-Cliffs Iron Co. in Hibbing since 1920. Late in 1940 he was appointed superintendent of the Canisteo mine and moved to Coleraine, where he resided until his death.

O. J. Salisbury, 60, inventor of filter-press equipment and builder of concentrating plants near Challis, Idaho, and the Deer Trail mine, Marysvale, Utah, died on Jan. 21 in Altadena, Calif. Born and educated in Salt Lake City, he was prominently identified with the Utah mining and construction business until he moved to California in 1921.

John R. Van Evera, 92, prominent in Utah mining for many years, died in Crosby, Minn., on Feb. 2, 1943. Born at Canajoharie, N. Y., in 1851, he spent his youth in Ohio, Michigan, and Colorado. The mining properties acquired by Mr. Van Evera later became the properties of the Chief Consolidated Mining Co. For years, he operated at Goldfield, Nev.

Stanley Hunter died on Dec. 4, 1942, at the age of 78. For the greater part of his career he was in the service of the Department of Mines of Victoria, Australia, holding the position of engineer for boring. In this capacity he carried out an extensive survey of deep auriferous leads of the State, the results of which, together with deep alluvial mining methods, were published in a work entitled "The Deep Leads of Victoria," which has been regarded as a leading treatise on this branch of mining.

John Thiebes, who had followed the mining profession for over 50 years, first in the West and since 1901 identified with many enterprises in Mexico until his going to San Diego, Calif., in 1941, died in that city on Jan. 16 at the age of 77. Mr. Thiebes was connected in various capacities with many Mexican mining companies, as official and in geological, examination, and consulting work. He was well known and highly esteemed by men of the mining fraternity throughout the republic. He served in the U. S. army from 1885 to 1893.

Bela Low, mining engineer, formerly professionally active in Russia, Canada, and Mexico, and for the past year consultant to the War Production Board, died in Washington, D. C., on Dec. 25, at the age of 60. He had recently completed a voluminous report for WPB after an inspection tour of copper mines in various regions of the United States, with recommendations for improving and expanding production. Mr. Low was born of American parents in Berlin. He received his degree of M.E. from the

University of Freiberg. He had long been active in New York City in circles devoted to the study of social and economic problems.

James Horsbrugh, one of Australia's best-known mining engineers, died on Nov. 21, 1942. Mr. Horsbrugh was trained at the Sydney University, whence he was appointed metallurgist to Chillagoe Mining & Railway Co., Ltd., in North Queensland. He was then general manager of Mt. Molloy Copper Co., resigning to accept the general managership of Chillagoe Mining & Railway Co., Ltd., where he remained for seven years. In 1914 he became assistant general manager of Mt. Morgan Gold Mining Co., Ltd. and in 1926 was appointed chairman of the North Australian Commission. For the past seven years he acted as technical adviser to Mt. Morgan, Ltd.

Roy H. Clarke, prominent mining engineer of the Pacific northwest, who had made his home and headquarters in Spokane for more than 50 years, was killed Jan. 21 by a fall in the shaft of the Linfor copper mine, on the North Fork of the Coeur d'Alene River. He was making an examination for the RFC, which had furnished the funds for unwatering the property. The weather was bitter cold and the ground covered with snow and ice and it took more than two hours to take him 15 miles to a hospital, where he died. Mr. Clarke began his business career at the Bunker Hill mine and did professional work in most of the mining districts of the Pacific northwest. He served two years as president of Northwest Mining Association and one term as chairman of Columbia Section of American Institute of Mining Engineers. He and Stanly A. Easton, president of Bunker Hill & Sullivan Mining Co., were classmates in the University of California. He belonged to the Delta Kappa Epsilon Fraternity. He was 73.

LETTERS

Army-Navy Engineering Training Programs

THE EDITOR:

THE recently announced educational plans for the Army Specialized Training Program and the Navy College Training Program (V-12) for military personnel, seems to be definitely established. You are undoubtedly aware that these plans include college work in engineering for a period of up to 72 weeks for the Army and 128 weeks for the Navy. The Army and Navy will give screening tests and designate the best-qualified men to receive this educational work, and the total numbers involved are in the neighborhood of 200,000 men.

At the present time there are provisions for training in the following curricula:

Electrical Engineering
Mechanical Engineering
Civil Engineering
Chemical Engineering

You will note that no provisions have been made for curricula in Mining and/or Metallurgical Engineering. It appears to me that this is a most unwise step. In spite of the fact that no provisions have been made for curricula in these fields, the actual situation is about as follows: The Army has been and is now furloughing experienced miners from military duty so that they may return to the mines and help maintain a continued and increasing supply of minerals for the war effort. This war is making demands upon the metallurgical industries that heretofore have been undreamed of. The demand for qualified technical men in these fields is now many times greater than it has ever been, and yet we are faced with this situation of a complete stoppage of technical training.

One may very well say that there isn't any place in the military forces for mining and metallurgical engineers, and I am perfectly willing to grant that the opportunity for complete use of this technical training in the Army is limited. On the other hand, so far there has been no use of chemical warfare and the Army has little use for chemical engineers. The Army does not need mechanical engineers, but it does need mechanics for maintenance of equipment, and this does not require a college or university degree.

I believe this proposed educational plan is looking forward to the post-war period with the intention of furnishing industry with young men of the proper training. I maintain that the loss to industry will not be a linear and simple function of time, but rather that their loss will be nearer the square or cube of time and that a cessation of training in the mineral and metal industries for three years will actually require a period of nine or more years before a return to a balanced supply and demand of trained men can be expected.

So far as I can learn, the mining and metallurgical industries are not represented in the U. S. Office of Education or in the committee charged with establishing higher education for members of the military forces. Therefore, I believe it would be wise for *Engineering and Mining Journal* to take such steps as are necessary to present this situation to the proper committees, military authorities, and the U. S. Office of Education and seek an immediate solution to the problems and insist upon provisions being made for including training in the mineral and metal industries.

I shall be glad to assist, in any way possible, in the furtherance of any efforts you may wish to make toward alleviation of this situation.

HAROLD L. WALKER,
Head of the Department
Dept. of Min. and Met. Engrg.,
Univ. of Illinois, Urbana.

Mining and Post-war Policies

THE EDITOR:

FRANCIS A. THOMSON, in a letter in your December issue, discusses the tariff question in connection with the Atlantic Charter and infers that free trade would lower the standard of living in the United States. There is no economic justification for a tariff. Foreign trade consists of an *exchange* of goods—that is, the products of labor in one country are exchanged for the products of labor in another country. The fact that the exchange takes place indicates that the labor in each country received the wage determined by economic conditions. The exchange may have been made indirectly through other countries, but exports must be paid for by imports, and, if imports are prevented by a tariff, no exports can be paid for. Exports from one country are imports to another; if an exchange of goods in domestic commerce results in a gain to both parties, why should a similar exchange in foreign commerce result in a loss to both?

Gold is a commodity differing from others only in that it is used as the standard by which the value of other commodities is measured. Many of those that believe foreign commodities should be kept out by means of a tariff make an exception of gold, and others complain bitterly because the Treasury is continually buying gold shipped to this country in exchange for our exports. The gold miners have never been protected by a tariff, but have had their costs increased by tariffs, supposedly to foster other industries.

If it results in a saving of labor to exchange cotton raised in this country for iron ore mined in India, why is it to our disadvantage? Why should we impose a duty to increase the cost of iron, and, at the same time, ruin the market for cotton? Why spend money on labor-saving devices to lower costs, then raise them by a tariff and, at the same time, spoil the market for our exports? The value of imports must equal the value of exports if they are paid for, and, when one of the commodities thus imported by a nation consists of gold it is said to have a "favorable balance of trade." Gold can be exchanged for any other commodity, so why should the receipt of gold be considered "favorable" when the receipt of other commodities is supposed to be unfavorable? Perhaps because it is used as security for borrowing money by governments, and prosperity can be temporarily increased by borrowing and spending money. The fact remains, however, that the only way to increase the prosperity of an individual or of a nation is to increase the production of those goods and services which raise the standard of living, and it is obviously more economical for each individual all over the world to produce what he is best able and fitted to produce and to exchange this production for his particular needs rather than for each to produce every item of his wants for himself.

The only way to increase wealth is to increase the production of wealth, and, except for war purposes, the more wealth produced, no matter by whom, the greater the prosperity for all. The futile effort to increase wages and prices by limiting production and supply and by restricting trade inevitably results in a lower standard of living, and, when carried to extremes by groups or nations, is usually the cause of unemployment and even war.

ARTHUR B. FOOTE
Grass Valley, Calif.

Summary of the MARKETS

EXCEPT FOR ESTABLISHING the maximum price of refined platinum at $35 an ounce troy, a reduction of $1 from the published official quotation, OPA did little during the last month to disturb the market for non-ferrous metals. For a time it looked as if the price of tungsten ore in the open market might rise, but this threat was removed on Feb. 22 in a warning directed at non-marginal producers to stabilize quotations on the old basis. The *E. & M. J.* price index of major metals for February continued at 88.74 for the sixth consecutive month.

Modification of the premium price plan to permit higher levels for lead and zinc to support marginal producers was announced officially in Washington.

Distribution of copper in this country during the second quarter of this year should reach 600,000 tons, according to WPB. This huge total will be supplied out of domestic production, imports, salvaged material, and scrap.

UNITED STATES MARKET

1943 Feb.	Electrolytic Copper: Domestic (a) Refinery	Electrolytic Copper: Export (b) Refinery	Straits Tin: New York	Lead: New York	Lead: St. Louis	Zinc: St. Louis
1	11.775	11.700	52.000	6.50	6.35	8.25
2	11.775	11.700	52.000	6.50	6.35	8.25
3	11.775	11.700	52.000	6.50	6.35	8.25
4	11.775	11.700	52.000	6.50	6.35	8.25
5	11.775	11.700	52.000	6.50	6.35	8.25
6	11.775	11.700	52.000	6.50	6.35	8.25
8	11.775	11.700	52.000	6.50	6.35	8.25
9	11.775	11.700	52.000	6.50	6.35	8.25
10	11.775	11.700	52.000	6.50	6.35	8.25
11	11.775	11.700	52.000	6.50	6.35	8.25
12	Holiday	11.700	Holiday			
13	11.775	11.700	52.000	6.50	6.35	8.25
15	11.775	11.700	52.000	6.50	6.35	8.25
16	11.775	11.700	52.000	6.50	6.35	8.25
17	11.775	11.700	52.000	6.50	6.35	8.25
18	11.775	11.700	52.000	6.50	6.35	8.25
19	11.775	11.700	52.000	6.50	6.35	8.25
20	11.775	11.700	52.000	6.50	6.35	8.25
22	Holiday	11.700	Holiday			
23	11.775	11.700	52.000	6.50	6.35	8.25
24	11.775	11.700	52.000	6.50	6.35	8.25
25	11.775	11.700	52.000	6.50	6.35	8.25
26	11.775	11.700	52.000	6.50	6.35	8.25
27	11.775	11.700	52.000	6.50	6.35	8.25
AVERAGES FOR MONTH						
Feb.	11.775	11.700	52.000	6.50	6.35	8.25
AVERAGES FOR WEEK						
Feb.						
3	11.775	11.700	52.000	6.50	6.35	8.25
10	11.775	11.700	52.000	6.50	6.35	8.25
17	11.775	11.700	52.000	6.50	6.35	8.25
24	11.775	11.700	52.000	6.50	6.35	8.25
CALENDAR WEEK AVERAGES						
Feb.						
6	11.775	11.700	52.000	6.50	6.35	8.25
13	11.775	11.700	52.000	6.50	6.35	8.25
20	11.775	11.700	52.000	6.50	6.35	8.25
27	11.775	11.700	52.000	6.50	6.35	8.25

SILVER, GOLD AND STERLING EXCHANGE

1943 Feb.	Sterling Exchange: "Checks" (Nominal)	Sterling Exchange: "90-day demand"	Silver: (c) New York	Silver: London	Gold: London	Gold: (d) United States
1	401.000	(f)	44.750	23.500	168s	$35.00
2	401.000	(f)	44.750	23.500	168s	35.00
3	401.000	(f)	44.750	23.500	168s	35.00
4	401.000	(f)	44.750	23.500	168s	35.00
5	401.000	(f)	44.750	23.500	168s	35.00
6	401.000	(f)	(e)	(e)	(e)	35.00
8	401.000	(f)	44.750	23.500	168s	35.00
9	401.000	(f)	44.750	23.500	168s	35.00
10	401.000	(f)	44.750	23.500	168s	35.00
11	401.000	(f)	44.750	23.500	168s	35.00
12	Holiday	(f)	Holiday	23.500	168s	Holiday
13	401.000	(f)	(e)	(e)	(e)	35.00
15	401.000	(f)	44.750	23.500	168s	35.00
16	401.000	(f)	44.750	23.500	168s	35.00
17	401.000	(f)	44.750	23.500	168s	35.00
18	401.000	(f)	44.750	23.500	168s	35.00
19	401.000	(f)	44.750	23.500	168s	35.00
20	401.000	(f)	(e)	(e)	(e)	35.00
22	Holiday	(f)	Holiday	23.500	168s	Holiday
23	401.000	(f)	44.750	23.500	168s	35.00
24	401.000	(f)	44.750	23.500	168s	35.00
25	401.000	(f)	44.750	23.500	168s	35.00
26	401.000	(f)	44.750	23.500	168s	35.00
27	401.000	(f)	(e)	(e)	(e)	35.00
AVERAGES FOR MONTH						
Feb.	401.000	...	44.750	23.500	....	35.00
AVERAGES FOR WEEK						
Feb.						
3	401.000	.....	44.750			
10	401.000	.....	44.750			
17	401.000	.....	44.750			
24	401.000	.....	44.750			

Calendar week averages, New York Silver: Feb. 6th, 44.750; 13th, 44.750; 20th, 44.750; 27th, 44.750.
(e) Not quoted (Saturday). (f) No quotation.

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Owing to the World War and the disruption of normal trade relations, our export copper quotations, since September, 1939, have been based largely on f.a.s. transactions, ex United States ports. We deduct .05c. from the f.a.s. basis (lighterage, etc.) to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c per pound over the current market for Prime Western but not less than 1c over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for commond lead, and do not include grades on which a premium is asked.

(c) Silver other than newly-mined domestic, by Handy & Harman. Under Treasury order of July 6, 1939, the price on domestic newly-mined silver mined subsequent to July 1, 1939, was fixed at 71.11c per troy ounce. Handy & Harman's quotation on newly-mined domestic silver, 999 fine was 70⅝c. throughout February.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which at present is equal to $34.9125.

However, approximately 75 percent of the total will consist of new copper obtained from various primary sources. Domestic consumers obtained copper on the basis of 12c., Connecticut Valley basis. Foreign copper was purchased by Metals Reserve Co. at 11.75c., f.a.s. United States ports. Importations are being maintained at a high level.

Lead consumption has varied little in recent months, holding around 65,000 tons a month. To supply this tonnage the Government has been releasing about 13,000 tons of lead of foreign origin monthly to domestic consumers.

Zinc is being allocated to consumers not on the "essential" list in diminishing quantities. This policy is being pursued to build up the emergency stockpile, particularly in reference to High Grade. Production of High Grade is expanding.

Tin production at the smelter in Texas is increasing. Both Grade A and Grade D metal are being produced, the last-named being equivalent to Chinese tin.

MONTHLY AVERAGES

Monthly averages for copper, lead, zinc, tin, silver (New York and London), gold, and sterling exchange appear on preceding page. Average prices of miscellaneous metals for January and February follow:

	Jan.	Feb.
Quicksilver, N. Y. flask.	196.000	196.000
Antimony (a).....	16.049	16.049
Antimony, bulk, Laredo.	14.500	14.500
Antimony, bulk, N. Y...	15.509	15.509
Antimony, Chinese (b).	16.500	16.500
Platinum, oz. troy.....	36.000	35.000
Cadmium (c).....	90.000	90.000
Cadmium (d).....	92.500	92.500
Cadmium (e).....	95.000	95.000
Aluminum, ingot.....	15.000	15.000
Magnesium, ingot.....	20.500	20.500

(a) New York, packed in cases, in lots of 5 tons or more but less than a carload. (b) Nominal. (c) Producer's price for commercial sticks. (d) Average of producer's and plater's quotations. (e) Special shapes sold to platers.

E & M J PRICE INDEX

Weighted index of non-ferrous metal prices (copper, lead, zinc, tin, silver, nickel, and aluminum). The average for the years 1922-1923-1924 equals 100.

1929.....	110.33	1936.....	73.45
1930.....	82.87	1937.....	90.86
1931.....	60.20	1938.....	73.67
1932.....	48.26	1939.....	77.71
1933.....	59.79	1940.....	79.22
1934.....	69.59	1941.....	83.49
1935.....	74.66	1942.....	86.80

	1941	1942	1943
January	82.48	85.39	88.74
February	82.76	85.90	88.74
March	83.27	85.90	....
April	83.48	85.90	....
May	83.51	85.90	....
June	83.48	85.90	....
July	83.60	85.90	....
August	83.39	85.90	....
September	83.34	88.74	....
October	83.84	88.74	....
November	84.32	88.74	....
December	84.42	88.74	....

CURRENT PRICES—MISCELLANEOUS METALS, ORES, AND NON-METALLIC MINERALS

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

(March 1, 1943)

MISCELLANEOUS METALS

Aluminum, ingot, 99 plus per cent, lb	15c.
Antimony, domestic, spot, lb. 5 ton or more	16.049c.
Bismuth, ton lots, lb	$1.25
Cadmium, commercial sticks, lb	90c.
Calcium, lb., ton lots 97 @ 98 per cent	$1.25
Chromium, 97 per cent grade, lb	89c.
Cobalt, 97 to 99 per cent, per lb	$1.50
Nickel, electrolytic cathodes, lb	35c.
Magnesium, 99.8 per cent, carloads, lb	20½c.
Palladium, troy oz	$24.00
Platinum, (Official quotation) troy oz	$35.00
Quicksilver, flask of 76 lb., 100 flasks or more	$196.00@$198.00
Radium, mg. radium content	$25.00@$30.00
Selenium, 99.5 per cent, lb	$1.75
Silicon, minimum 97 per cent, spot, carloads lb	14.75c.
Tellurium, lb	$1.75
Thallium, 100 lb. or more, lb	$10.00
Titanium, 96 to 98 per cent, lb	$5.00

METALLIC ORES

Beryllium Ore, 10 to 12% BeO. f.o.b. mines, ton	(b) $80.00@$90.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry, 48% Cr_2O_3, 2.8 to 1 ratio	$41.00
48% Cr_2O_3, 3 to 1 ratio	$43.50
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$4.75
Mesabi bessemer	$4.60
Old Range non-bessemer	$4.60
Mesabi, non-bessemer	$4.45
Lead (Galena) 80 per cent, Joplin, Mo., ton	$76.54
Manganese (dutiable) f.o.b. cars Atl. ports, long ton unit Mn:	
50 per cent	79.8c.
48 per cent	78.8c.
46 per cent	76.8c.
Manganese Ore, domestic, 48%, f.o.b. mines, l.t. unit	96c.@$1.00
Molybdenum Ore, 90%, per lb. of MoS_2, f.o.b. mines	45c.
Tungsten Ore, per unit of WO_3:	
Chinese, 65 per cent, duty paid	(b) $24.00
Domestic, 65 per cent and upward	(a) $26.00
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	27.50c
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo; per ton	$55.28

(a) Prices at mines, small lots, usually several dollars less. (b) Nominal

METALLIC COMPOUNDS

Arsenious Oxide (arsenic) lb	4c.
Cobalt Oxide, 70 @ 71 per cent, lb	$1.84
Copper Sulphate, 100 lb	$5.15

ALLOYS

Beryllium Copper, 2.5 to 3 percent Be, per lb. of contained Be	$15.00
Ferrochrome, 65 @ 70 percent per pound of Cr contained	13c.
Ferromanganese, 78 @ 82 per cent, gross ton	$135.00
Ferromolybdenum 55 @ 65 per cent Mo. lb. of Mo. contained	95c.
Ferrosilicon, 50 per cent, gross ton	$74.50
Ferrotungsten, 75 @ 80 per cent, lb. of W contained	$1.90
Ferrovanadium, per lb. of V, delivered	$2.70@$2.90
Silicomanganese, 1½ per cent C, gross ton	$135.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canadian (Quebec) mines (U. S. funds), ton:	
Crude No. 1	$650@$750
Crude No. 2	$165@$385
Spinning fibers	$124@$733
Paper stock	$44@$49.50
Shorts	$14.50@$26.50
Vermont, f.o.b. Hyde Park:	
Shingle stock	$62.50@$65.00
Paper stock	$44.00@$53.00
Shorts	$14.50@$28.50
Floats	$19.50
Barytes, long ton:	
Georgia, crude	$9.00
Missouri, 93 per cent $BaSO_4$, less than 1 per cent iron	$6.75@$7.25
Bauxite, long ton:	
Domestic, crude, 50 @ 52 per cent (not dried)	$5.00
Domestic, chemical, 55 @ 58 per cent	$7.50@$8.50
Domestic, abrasive, 80 @ 84 per cent	$16.00
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$15.00
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass-spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 85–5 per cent, all rail movement, ton	$28.00
Ground, 95 @ 98 per cent, bulk, ton	$34.00
Acid, 98 and 1 per cent, bulk, ton	$35.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, f.o.b. Washington	$22.00
Mica, per lb., North Carolina, No. 1 and 2 quality:	
1½ x 2 in	90c. @$1.20
2 x 2 in	$1.50@$2.00
3 x 3 in	$2.00@$2.75
3 x 4 in	$2.50@$3.25
3 x 5 in	$3.00@$4.00
White, ground, ton	$60.00@$80.00
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	12c., nom.
Silica, in bags, 325 mesh, ton	$20.00@$40.00
Sulphur, Texas, mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
Vermont, extra white, 200 mesh	$9.50@$10.50
Tripoli Missouri, ton:	
40 mesh, cream colored	$14.50
200 mesh, cream colored	$26.00

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton: Basic	$23.50
Steel, base prices, Pittsburgh Billets, gross ton	$34.00
Structural shapes, 100 lb	$2.10

New Books

ECONOMIC MINERAL DEPOSITS. *By Alan M. Bateman. John Wiley and Sons, Inc., New York, Pp. 898. Price $6.50.*

DESIGNED primarily as a textbook for advanced students in economic geology, this volume will be recognized as a milestone along the road of economic geology education. Although the work is adapted to the use of students less advanced than in the case of Lindgren's classic, the treatment presupposes a general background in geology hardly less than that of senior students majoring in the science. Being designed for less advanced readers, the book treats ore deposits according to their shape and disposition rather than genetically, for which reason it may receive some criticism from mature geologists. Reflecting the wide experience of its author, the work is the best rounded of economic geology texts in the treatment it gives to all classes of mineral deposits, including petroleum, and lends the most emphasis to economic aspects. Part I, comprising nearly half the book, is devoted to principles and processes; parts II and III consist of descriptions of metallic and non-metallic deposits. Subjects not commonly included in the treatment of economic geology include: history of the use of minerals and of the development of economic geology; resources, international relations, and conservation of minerals; geology in prospecting, exploration, development, and valuation; and the extraction of metals and minerals.

On the debit side, the book reflects the demands imposed by the marketing side of the publishing business, by compressing a grand subject into small space; for this reason, some subjects may be too concisely treated for genuine comprehension by the uninitiated, without collateral reading.

In additon to being a textbook, the work will certainly find its way into most libraries of economic geology, and will be found useful for "refresher" purposes by mature geologists and mining men.

SURVEY OF MINES, 1942-43, CANADA AND NEWFOUNDLAND. *Financial Post, Maclean Publishing Co., Ltd., Montreal and Toronto, Canada. Pp. 224. Price $2.*

IN ISSUING the 17th annual edition of this Survey the publishers direct attention to the changes that have taken place in Canada's mining industry. Base-metal production has increased and probably will reach a new high in 1943. Strategic mineral output will show a sharp upturn as new deposits of molybdenum, tungsten, and chromite come into production. Gold mining is temporarily in eclipse, but it is expected to become a bulwark for reconstruction and prosperity in post-war Canada. The Survey contains the usual detailed information on thousands of mining companies, including maps, stock prices, dividends, ore reserves, earnings, directors, and other data.

QUINN'S METAL HANDBOOK AND STATISTICS, 1942. *Compiled by F. B. Rice-Oxley in collaboration with L. H. Tarring. Published by Metal Information Bureau, Ltd., Ibex House, Minories, London, E. C. 3. Pp. 380. Price 10s. post free.*

DESPITE the many obstacles arising from war conditions, the 29th annual edition of this pocket-size international statistical reference book on metals and minerals contains much new and interesting information. Prices are listed for iron and steel, non-ferrous metals, scrap metals, ores and precious metals, together with production and consumption, and import and export tables. Estimated figures of world production of some of the main non-ferrous metals in 1941 are a valuable feature in the absence of official statistics. Opportunity has been taken to revise and enlarge the book, and many tables have been rearranged to facilitate quick and easy reference to the world situation, as well as to that of individual countries.

FERROUS PRODUCTION METALLURGY. *By John L. Bray. John Wiley & Sons, Inc., New York; Chapman & Hall, Ltd., London. Pp. 457. Price $4.*

TEACHERS OF METALLURGY will welcome this companion volume to "Non-Ferrous Production Metallurgy," by the same author, published in 1941. It follows the same general plan of the earlier work in that it confines itself solely to consideration of the means and methods of producing ferrous products, and leaves their metallography, fabrication, and other aspects to special works on those subjects. An early chapter discusses the raw materials used in the blast furnace, and their preliminary preparation for the removal of impurities. An extensive chapter on the iron blast furnace illustrates and describes its construction and operation, discusses the physical-chemistry of the process, and gives sample calculations for determining the burden. Other processes receiving attention are those for making wrought iron, the cementation, crucible, Bessemer, basic open-hearth, acid open-hearth, and electric. Chapters on the rôle of scrap, on ingots and ingot molds, and on ferro-alloys round out the book.

ZINC IN WARTIME. *American Zinc Institute, 60 E. 42d St., New York City. Pp. 26. Free in single copies.*

A BOOKLET, mainly pictorial, illustrating the numerous applications of zinc in the war economy. Although designed primarily to acquaint the public with the usefulness of zinc, the booklet should also be useful as a spur to the morale of workers engaged in zinc production.

PUBLICATIONS

RECEIVED

Colorado. Annual Report of Commissioner of Mines, 1941. Bureau of Mines, State Capital, Denver. Pp. 52.

Inventory of Mineral Properties in Snohomish County, Washington. By W. A. Broughton, Division of Geology, State of Washington, Olympia, Wash. Pp. 64 plus map. Price 25c.

Virginia's War Mineral Resources. By Arthur Bevan, State Geologists, Virginia Geological Survey, University, Va. Pp. 18. Also *Virginia's Mineral Industries* by the same writer. Pp. 12.

Map of California, showing major rock units and their significance to exploration for chromite deposits. Scale 400 miles to 1 inch. State Division of Mines, Ferry Building, San Francisco.

Annotated Geological Bibliography of Virginia. By Joseph K. Roberts, professor of geology, University of Virginia. Contains principally abstracts of 2568 articles and papers. Alderman Library, University of Virginia, Charlottesville, Va. Pp. 726. Price $5.

Bibliography of Geology and Mineral Resources of Montana. Memoir 21. Montana Bureau of Mines and Geology, Butte, Mont. Pp. 350. Price $3.

Minerals of New Mexico. By Stuart A. Northrop, University of New Mexico Bulletin, University of New Mexico Press, Albuquerque, N. M. Pp. 387. Price $1 paper; $1.75, cloth.

Yearbook of the Mining Industry in Peru in 1941 (in Spanish). By Jorge Hohagen, chief engineer of the Department of Statistics, Lima, Peru. Pp. 201.

Valuation of Iron Ore Properties, St. Louis County, Minnesota (Mesabi Range), Year 1942. Compiled by Walter H. Borgen, Duluth, County Auditor. Pp. 23, plus separate tabulation.

Cobalt Deposits in Blackbird District, Lemhi County, Idaho. Preliminary report by A. L. Anderson, Idaho Bureau of Mines and Geology, Moscow, Idaho. Pp. 34. Price 50c.

Directory of Washington Mining Operations. By Ward Carithers. State Division of Mines and Mining, Olympia, Wash. Pp. 36.

Publications on Geology and Mineral Resources of Virginia. By Arthur Bevan, Virginia Geological Survey, University, Va. Pp. 57.

Dolomites and Limestones of Western Ohio. Geological Survey of Ohio, Columbus, Ohio. Pp. 468. Price $1.50.

Director of the Mint, Annual Report 1942. For sale by Superintendent of Documents, Washington, D. C. Price 50c.

Geology of the Appalachian Valley in Virginia. By Charles Butts. Bulletin 52, Virginia Geological Survey, University, Va. Part I, geologic text and illustrations. Pp. 568. Part II, fossil plates and explanations. Pp. 271.

Strategic Mineral Occurrences in Interior Alaska. By H. R. Joesting. Pamphlet No. 1, Department of Mines, College, Alaska. Pp. 46.

Mineral Resources of Arkansas. By George C. Branner. Bulletin 6. Arkansas Geological Survey, Little Rock, Ark. Pp. 101.

Dolomites and Magnesian Limestone in Georgia. By Dr. A. S. Furcron. Information Circular 14. Division of Mines, Mining and Geology, State Capitol, Atlanta, Ga. Pp. 30.

NEWS OF THE INDUSTRY

A.I.M.E. Speakers Propose Stockpile Legislation by Present Congress

Convinced of futility of attempts to end future wars, mining men urge permanent stockpiles for national security; would deprive "bandit" nations

AT WELL-ATTENDED SESSIONS, during its annual meeting held in New York City Feb. 15 to 18, inclusive, members of the American Institute of Mining and Metallurgical Engineers presented several discussions of technical developments in mining and metallurgy, with particular stress on applications furthering the war effort, and described activities of the industry in meeting wartime demands. The Society of Economic Geologists held its annual meeting concurrently, and the two organizations participated jointly in geological sessions.

A highlight of the meeting was a session on stockpiling and mineral supply, wherein recommendations were made for a permanent stockpiling program to safeguard the nation in any future wars against such mineral shortages as have hampered the current war effort. W. Y. Elliott, of the Stockpile Branch of the War Production Board, opened the discussion with a description of the current program, and posed questions as to how long a war the stockpile program should contemplate and as to legislation to determine the post-war status of stockpiles. W. O. Hotchkiss, of Rensselaer Polytechnic Institute, emphasized his belief that future wars could not be prevented, and recommended a permanent stockpile program as part of a future policy of national security. He recognized that large mineral stockpiles might be used by an unsympathetic government as a club over the industry's head, but asserted that the advantages completely outweighed this consideration. R. C. Allen, of Oglebay, Norton Co., Cleveland, pointing out that agitation for stockpiles had commenced in the early twenties but had been disregarded by a war-weary nation, suggested that the industry should take active steps to educate Congress to the need and should press for suitable legislation by the present Congress.

Frank A. Ayer, of the Copper Branch of WPB, described the problems and activities of his organization with respect to supplying copper for war needs. C. K. Leith, also of WPB, pointed out that an adequate national security program in regard to minerals would involve the maintenance of technical skill and productive and fabricating capacity as well as stockpiles, also that to fulfill the implications of the Atlantic Charter as to an enforced peace, precautions must be taken to prevent "bandit" nations from accumulating the mineral supplies necessary to wage war.

A. M. Bateman, in discussing the activities of the Board of Economic Warfare in obtaining minerals from foreign sources, pointed out the enormous needs for some minerals, such as copper, which completely outstripped all pre-war estimates, and the unexpected importance of many minor minerals, such as quartz crystals, because of new technical developments requiring their use. C. W. Wright, also of BEW, gave an illustrated talk on South American mineral development, and J. T. Singewald discussed recent mineral developments in the Argentine.

Another highlight of the meeting was the Institute of Metals lecture on the electron microscope and its uses, by V. K. Zworykin, of Radio Corporation of America laboratories.

At the "All-Institute" luncheon, Dr. Harvey N. Davis, director of the Scientific Research and Development Division of WPB, lectured on "Metals and the War," pointing out the supreme importance of metals in the war program and describing the problems and activities of his division. Dr. Davis stressed the importance of fostering many new developments through the pilot-plant stage even though they may not be economic at present, on the basis that a long war might require their use. He cited aluminum as an example, stating that although accessible bauxite reserves now appear to be adequate, a long war might force the utilization of low-grade aluminous materials.

The feature speaker at the annual banquet was William M. Jeffers, WPB Rubber Administrator. Former President Herbert Hoover was a surprise visitor. He made a short talk and was given an enthusiastic ovation. The new Institute president, C. H. Mathewson, of the department of metallurgy of Yale University, was introduced. John R. Suman was awarded the Anthony Lucas medal "for distinguished achievement in improving the technique and practice of producing petroleum." Honorary membership was awarded to Paul D. Merica, of the International Nickel Co., and to Essington Lewis, of Broken Hill Proprietary Co., Ltd., of Melbourne, Australia, this in the latter's absence.

New vice presidents of the Institute are Erle V. Daveler, of New York, and Harvey S. Mudd, of Los Angeles. New directors are: C. H. Mathewson, Charles H. Herty, Jr., Bethlehem Steel Co., Bethlehem, Pa.; O. H. Johnson, Mine & Smelter Supply Co., Denver, Colo.; Russell B. Paul, New Jersey Zinc Co., New York City; F. A. Wardlaw, Jr., International Smelting & Refining Co., Salt Lake City, Utah.

Technical sessions were held on mineral industry education, mining methods, health and safety in mines, milling methods, Eastern magnetite mining, iron and steel metallurgy, non-ferrous metallurgy, secondary metals, industrial minerals, mining geology, geophysics, and petroleum.

At the annual dinner of the Geological Society of America and Society of Economic Geologists, Dr. C. K. Leith was awarded the Penrose medal for "eminent research in pure geology."

Labor Relations Board Certifies CIO Union

PURSUANT to an election held Jan. 25 among production employees of Bonanza Mines, Inc., a quicksilver producer at Sutherlin, Ore., the National Labor Relations Board certified the International Union of Mine, Mill & Smelter Workers, CIO, as exclusive bargaining agent. The election was a contest between this union and Quick Silver Mine Workers, A.F. of L.

The board also directed that elections should be held within 30 days of Feb. 19 among production and maintenance employees of the American Smelting & Refining Co. smelter at El Paso, Tex., to determine a contest between CIO and A.F. of L. unions; also to determine whether or not office employees wish to be represented by the A.F. of L. office employees' union.

An election was ordered within 30 days of Feb. 23 to determine if production and maintenance employees of the Ray Mines Division of Kennecott Copper Corp. at Hayden, Ariz., should be represented by the A.F. of L.

On Feb. 23, the board issued a "cease and desist" order to the Utah Copper Co. affecting its mines and mills near Salt Lake City, Utah, and demanding the disestablishment of the Employees General Committee, the Independent Association of Mill Workers, and also of the Independent Association of Mine Workers.

Trade Involves Phosphate Recovery Corporation

ANNOUNCEMENT has been made of full acquisition of Phosphate Recovery Corp., formerly jointly owned with International Minerals & Chemical Corp., by Minerals Separation North American Corp. Activities of the company will be carried on in future by Minerals Separation.

Concurrently, the flotation plants of Phosphate Recovery Corp. were acquired by International, the mines of which they serve. The largest is the new Peace Valley plant, in Florida. There are two other plants in Florida and two in Tennessee.

Custodian Now Offering Foreign Patents

THE Alien Property Custodian has announced that about 50,000 foreign patents of all kinds are available for use by domestic industry. The list comprises not only patents of enemy aliens, but also those of citizens of Axis-occupied countries, and, where the war effort or full post-war production are aided, patents of any aliens, enemy or otherwise. Classified lists are available from the Alien Property Custodian, Chicago, for 10c. each. Classifications include the following of interest to the mining and metallurgical industries: agitating; ammunition and explosive devices; boring and drilling; brakes; centrifugal-bowl separators; chemistry (25¢); classifying, separating, and assorting solids; clutches and power-stop control; conveyors, chutes, skids, etc.; conveyors, power driven; earth boring; electric furnaces; various applications of electricity; explosive compositions; fluid sprinkling; fuel and igniting devices; furnaces; gas pumps and fans; heat exchange; heating; internal combustion engines (25¢); land vehicles, dumping, wheel substitutes, wheels and axles; liquid and gaseous fuel burners; masonry and concrete structures; material handling; measuring and testing; metal forging, welding, founding, rolling, treatment, and working; metallic building structures; metallurgical apparatus; metallurgy; mills; mining and quarrying; motors; packed shaft or rod joints; pipe joints or couplings; pipes and tubular conduits; power plants; pumps; pushing and pulling implements; radiant energy (25¢); railway rolling stock, switches and signals, wheels and axles; recorders; resistances and rheostats; rod joints or couplings; roofs; signals and indicators; thermostats and humidostats; time-controlling mechanism; tools; valved pipe joints or couplings; valves; ventilation; and wells.

Enemy patents not already exclusively licensed will be licensed non-exclusively, royalty-free, and for the duration of the patent; those of citizens of enemy-occupied countries not exclusively licensed will be licensed non-exclusively, for the duration of the patent, and royalty-free until six months after the war; post-war royalties may be determined beforehand or left for subsequent adjustment. Patents exclusively licensed to bona fide American interests will not be disturbed unless the war effort is hindered. No stated policy is enunciated with reference to patents of citizens of neutral or allied foreign countries.

To Construct Aluminum Plant in Brazil

ECONOMIC Coordinator de Barros, of Brazil, stated last week that Brazil plans to construct an aluminum plant with a capacity of 25,000 tons a year. The plant, to be constructed with assistance from the United States, is to be expanded should conditions at the time of completion call for increased output to assist in the war program.

Orders 48-Hour Week for Non-Ferrous Metal Mines

EFFECTIVE Feb. 22, chairman McNutt of the War Manpower Commission proclaimed a compulsory 48-hour week to be followed in the mining, development, and milling of all non-ferrous metals and their ores. The order does not affect operations regularly employing less than eight people. It also does not apply in cases where application "(a) would be impracticable in view of the nature of the operations, (b) would not contribute to the reduction of labor requirements, or (c) would conflict with any federal, state, or local law or regulation affecting hours of work."

If fulfillment of the order would cause the discharge of workers who cannot "promptly be placed in suitable employment with other employers," the employer is instructed to report the situation to the regional manpower director or his representative by April 1, naming the employees and their occupations, and proposing a schedule for the timing of releases. The director can then set up a schedule for the gradual accomplishment of the longer work week and release of employees.

To Integrate the United Nations Copper Program

ON FEB. 10 Combined Copper Committee was formed by the Combined Production and Resources Board and the Combined Raw Materials Board to assemble and review data relating to supply, requirements, inventory, and consumption of copper so that the United States, the United Kingdom, and Canada may utilize available tonnages to best advantage in war production.

Harry O. King, director of the Copper Division of WPB, is chairman of the Combined Copper Committee, and will be assisted by the following American, British, and Canadian representatives:

Robert R. Nathan, Combined Production and Resources Board.

Lincoln Gordon, Combined Raw Materials Board.

A. McDougall, Combined Raw Materials Board.

M. I. Michaels, British Ministry of Supply Mission.

George McDonald, Metal Comptroller's Office, Canada.

Lt. Col. James Boyd, Services of Supply, United States Army.

Lt. Com. Paul F. Linz, United States Navy.

Creation of the committee on Feb. 10 followed a preliminary survey of the copper situation in the three countries. The report indicated the need for comprehensive and better integrated information on supplies available, requirements, and the numerous programs entailing the use of copper.

The copper group is the second of such groups formed by the three countries. The Combined Steel Committee was organized on Dec. 14, 1942. The coming visit to the United States of the British Metallurgical Committee will assist in the work of both committees.

Anticipate No Shortage of Iron Ore for War

THE Division of Industrial Economics of the National Industrial Conference Board has completed a survey of iron-ore reserves and is of the opinion that no shortage of high-grade iron ore impends, even if a consumption rate of 100,000,000 gross tons a year continues. The Board says:

"Controversy over the life of present high-grade reserves arises as a result of differences of opinion of the accuracy of both reserve and future production estimates. The fact that the decline in estimated reserves from the peak reached over twenty years ago has been considerably less than the amount of ore shipped from these properties is sometimes cited in support of claims that reserves have been underestimated. Thus, estimated iron-ore reserves of Minnesota declined 318 million tons from 1916 to the beginning of 1942, compared with shipments during this period of about 890 million tons. Similarly in Michigan, estimated reserves dropped only 79 million tons, whereas shipments totaled 316 million tons. It must be recognized, however, that each year of additional exploration and re-examination of company records should make the information on reserves more nearly accurate.

"How long heavy wartime demand of 100 million tons or more of Lake ore will continue cannot be forecast. Unless we assume a war of unusually long duration, it is unlikely that the war effort will be hampered by any shortage of ore. But it is also impossible to predict post-war demand for ore. Before the war, an annual output of 50 million tons a year was frequently considered 'normal.' Obviously, if war ends within a few years and production drops to the 50 million level, the life of deposits will be correspondingly increased. Although attention should be given to the wide fluctuation in ore shipments in the past, the greater capacity of the country to consume ore and the prospect of plans designed to achieve full employment must be considered.

"Estimated reserves of high-grade ore in the Lake Superior district amounted to 1.3 billion gross tons at the beginning of 1942, based on tax commission records. Though this estimate is regarded as conservative, the margin to be allowed for future discoveries and additions to supplies is a controversial issue. Numerous deposits of ore are found in other sections of the country, but for many years they supplied only about 15 percent of the steel industry's annual needs. Tax commission records place reserves of open-pit ore in the Lake district at 569 million gross tons, equal to 44 percent of the region's total reserves. These deposits can be mined at low cost and they permit great flexibility in production.

"This year's needs are estimated at 100 million tons, a figure expected to be the minimum demand for the duration. Mesabi is expected to supply over three-quarters of the district's shipments, with open-pit ore requirements placed at 53 million tons in 1943 by E. W. Davis in his report to the WPB. Because of its great resources of open-pit ore, Mesabi is the only range which can produce very

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(*Continued from page* 86)

large quantities of high-grade ore on short notice.

"Development of a large taconite concentration industry at Mesabi is Mr. Davis's principal recommendation for overcoming the high-grade ore shortage which he believes will occur in a relatively few years. Magnetic taconite reserves, which can be concentrated by commercial methods now in use, are placed at from 5 billion to 10 billion tons. The major drawback of Lake Superior taconite is its hardness, and costs of beneficiation would be too high to permit commercial exploitation at present ore prices. Large capital investments would be required, with estimates ranging from $6 to $10 per ton of annual concentrate capacity."

Vanadium Deposit Found by Survey Geologist

ANNOUNCEMENT has been made by the Interior Department that the vanadium deposit in western Wyoming now being worked by the Wyodak Coal & Mfg. Co., Homestake subsidiary, was discovered by W. W. Rubey, of the U. S. Geological Survey. The Phosphoria formation, source of phosphate rock, has been known for some time to contain vanadium, which is recovered in a process of phosphate treatment used by the Anaconda Copper Mining Co. However, chemical analysis of some samples collected by Rubey during his examination of the phosphate deposits disclosed that some shales closely associated with the Phosphoria formation were richer in vanadium than the phosphate rock. After the discovery Secretary Ickes withdrew the more promising public lands from mineral entry "in order to forestall speculative claim-staking that would jeopardize a large-scale program of rigorous testing and proper public control of the resource."

[Observers are at a loss to reconcile the policy indicated by this quotation with the Secretary's recent utterances as the champion of small business.—Ed.]

Mining Activity in Organ Mountains

L. B. BENTLEY and associates, of Organ, N. M., have shipped over 20 cars of zinc ore to the American Smelting & Refining Co. concentrator at Hanover, N.M. Copper and gold are recovered, in addition to zinc. Ed Lewis, of Las Cruces, is also shipping zinc ore from the same district to Hanover.

J. K. Standland, of Las Cruces, has rehabilitated the old Hayner-Manassee fluorspar property, 5 miles southeast of Las Cruces, and is now shipping two cars per week. Before final shipment the spar is cleaned in a small mill at Mesilla Park.

W. C. Frue, of Hendersonville, N. C., has leased a block of 16 claims belonging to the Sierra Azul Mining Co., of Las Cruces, and will soon be shipping manganese ore to the Metals Reserve depot at Deming.

CALIFORNIA

Lava Cap to Deepen Nevada City Mine

Natomas permitted to resume partial operation—Tungold provides larger water supply—New interest noted in copper-gold properties

▶ Lava Cap Gold Mining Corp., O. E. Schiffner, vice president and general manager, has started work on deepening the shaft at its Central mine, near Nevada City, Nevada County, another 400 ft. from the present 2,700 ft. to 3,100 ft., with new levels to be established at 200-ft. intervals. The level at 3,100 ft. will be known as the 16th. The incline shaft is sunk in country rock about 50 ft. from the footwall of the vein. Grade of ore mined currently is somewhat lower than that obtained from levels nearer the surface and averages $10 per ton. About 400 tons of ore a day are treated at the mill, which includes production from the nearby Banner mine, connected by tunnel with the Central shaft. Some 325 men are employed. The Lava Cap properties have been permitted to operate at capacity by the War Production Board because of production of flux for smelter and of arsenic. The ore also contains important silver values along with the gold.

▶ Natomas Co. has been granted permission by WPB to resume operations with two dredges in the Folsom area of Sacramento County, according to announcement by Senator Thomas McCormack, president. The two units were placed in operation within a week after receipt of the order. Only elderly employees totaling 38 are manning the dredges. The permit is granted for six months, at the end of which the situation will be reviewed. Five other dredge units remain idle.

▶ The water supply at the Tungold placer mine has been increased materially by the installation of a 10-in. pipe line from the Yellow Aster water main to the dredge pond, following completion of agreements between Rand Gold Dredging Associates, operators of Tungold, and Yellow Aster Mining & Milling Co., owners of the water system. The dredge, which was moved to the Tungold property, near Randsburg, Kern County, after finishing work near Cottonwood, Shasta County, recovers both gold and tungsten. M. E. Howard, superintendent, directs operations.

▶ Considerable interest is being shown in copper-gold mines long inactive in El Dorado County. Taylor Brothers, of Placerville, have leased the old Larkin mine, near Diamond Springs, and applied for an RFC loan to finance development. Arrangements for installation of machinery are also being completed. Other properties in the area attracting attention include the Noonday, Ford and Bob, and Irland. Veins worked years ago in the various mines yielded high-grade copper-gold ore.

▶ Hydraulic mining operations have been started at the Pioneer-Riffle mine, south of La Porte, Sierra County. The mine was granted permission by WPB to operate during the present season, and only older men are employed. A. J. Modglin is superintendent of the property.

▶ Anglo-American Mining Corp., Ltd., H. W. Klipstein, executive vice president, has taken an option on the Helen quicksilver mine, near Middletown, Lake County, operated for several years under lease from H. W. Gould, of H. W. Gould & Co., San Francisco, by Alan Fleishaker, with Thos. W. Robinson directing operations.

▶ Carl Howe, who has recently leased the Gray Eagle manganese mine, near Chinese Camp, Tuolumne County, plans early installation of machinery on the property covering about 40 acres of manganese-bearing ground. A crew of eight men is employed.

▶ Exploration work is to be started soon at the Ruby and Bush mines, in Moonlight Canyon, south of Engelmine, Plumas County, by T. Sobrero and associate of Greenville. The properties are thought to contain promising veins of copper ore.

▶ Operations have been resumed at the Ophir lead mine, northeast of Trona, San Bernardino County, by C. O. Mittendorf and associates, who operate the property under lease from Engineers Exploration Co. The mine has been idle since being shut down in the summer of 1942.

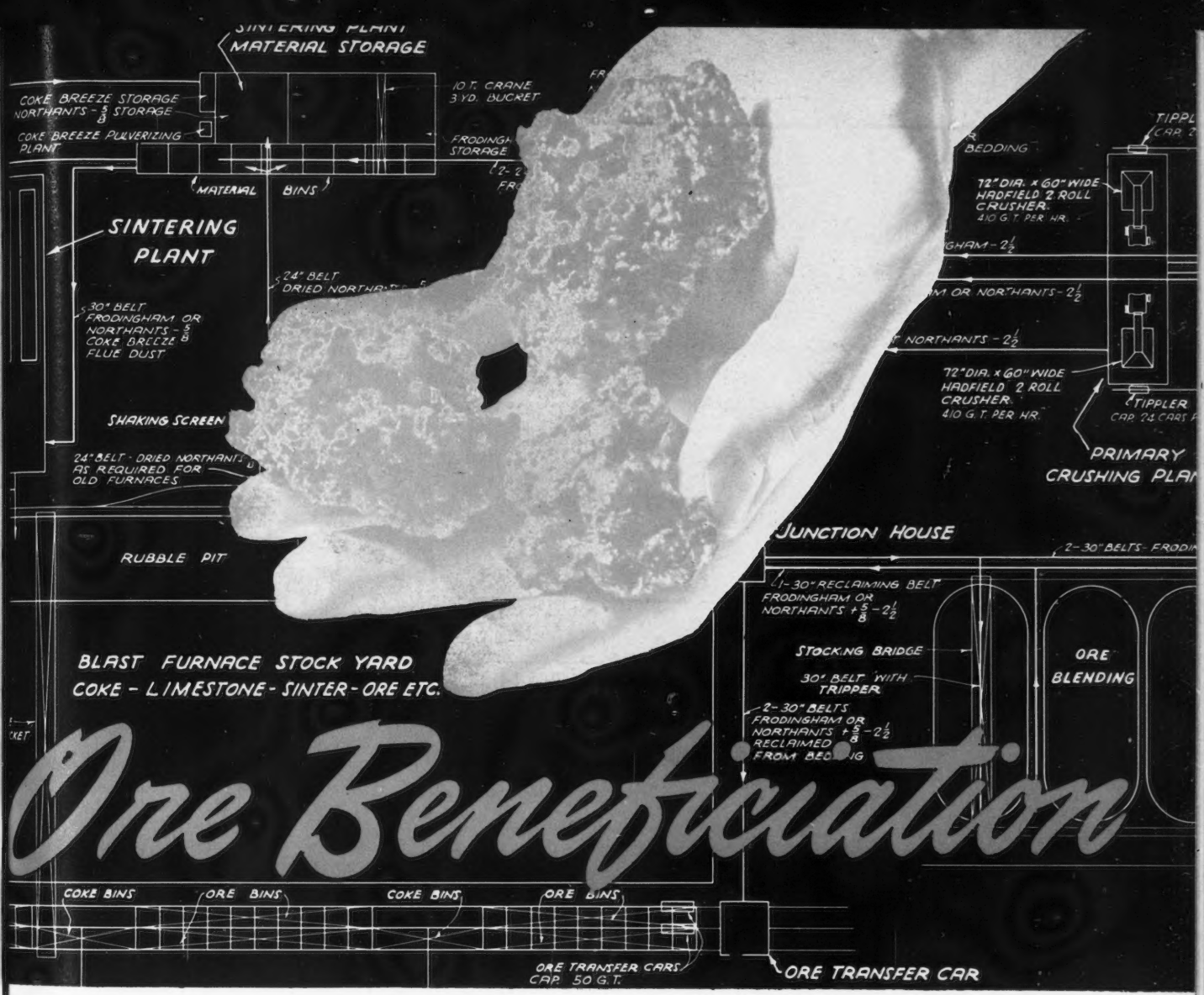
ARIZONA

State Bureau Completes Twin Buttes Survey

Denn shaft to be deepened—"76" mine suspends operations—RFC active in granting and considering loans

▶ The Arizona Bureau of Mines has announced the completion of detailed geological studies of a part of the Twin Buttes mining district, 30 miles south of Tucson. The work was undertaken as an aid to the U. S. Geological Survey and the U. S. Bureau of Mines in studies of latent sources of war metals. Production of the Twin Buttes district prior to 1929 was approximately $8,000,000, chiefly from copper. In recent years the district has been inactive. Properties studied were the Glance, Queen, King, Minnie, Contention, Morgan, and adjoining prospects. R. F. C. loans have been granted to unwater the Glance, Queen, and Morgan. There is an added interest in the Morgan due to the presence of some tungsten. The field work was done by B. S. Butler, University of Arizona geologist, and Eldred R. Wilson, of the Arizona State Bureau of Mines.

▶ The following RFC loans have been applied for: J. Dewey Chadwick, of Tombstone, has applied for $10,000 for the further development of the Conlig mine, in the Whetstone Mountains south of Benson. Preliminary testing of the ore has been done in the Fernstrom & Co. plant at Tucson. The ore is said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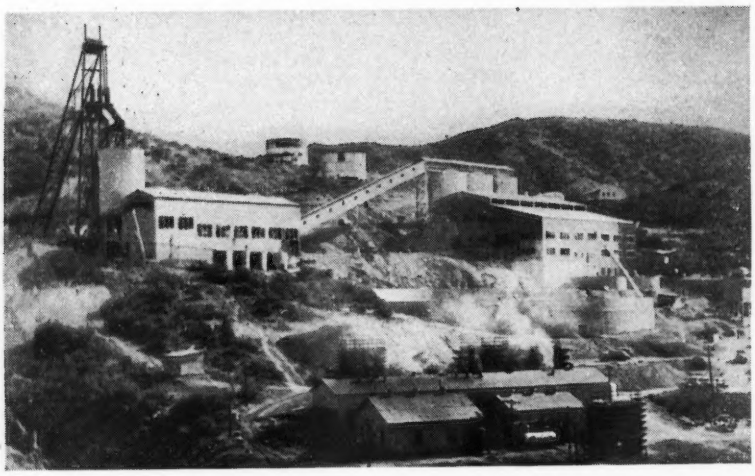

Surface plant of Bagdad Copper Co., in Arizona

to average 0.75 percent WO_3; J. C. Anglin, of Globe; Clay Young, of Felton; and J. N. Geaslin, of San Diego, Calif., lessees, have applied for a loan for the development on the Pittsburg-Tonto property, near Felton, in Gila County. The property is owned by Bert Belluzzi and Tony Menger, of Felton; Mountain Copper Corp., Pierre Perry, of Mayer, president, has applied for a loan to unwater two shafts below the 465-ft. level to reach orebodies indicated by diamond drilling. The properties are a part of the R. Herzog estate.

▶ The entire equipment of the Octave mine, including the buildings, has been purchased by the Independent Pipe & Steel Co. of Phoenix, and is in process of liquidation. The property has been operated at the rate of 150 tons daily up to recently by American Smelting & Refining Co., lessees. The property is ten miles east of Congress, in Yavapai County.

▶ Robert Nicolai and Harold Whealton, of Tucson, have leased the Plumed Knight and Mineral Hill mines from the Barnsdall Corp., which holds a controlling interest in the Mineral Hill Consolidated Copper Co. A new mill is contemplated for the Plumed Knight.

▶ Operations at the "76" mine of the La Bajada E E & E Corp. in the Tip Top district have been suspended for the duration and the equipment has been removed from the property.

▶ The Shattuck Denn Mining Corp. is preparing to extend the Denn shaft to the 2,900-ft. level.

▶ The following RFC mine loans have been granted to operators in Arizona recently: To Lawrence DeZee, of Crown King, $7,000, for further development of the Del Pasco mine, 4 miles north of Crown King; to Evert Breckenridge and Ethel Edwards, owners, of Mayer, $5,000 for development on the Butternut property, in the Big Bug district. To Tom Russell, of Mesa, and Tyree Trobaugh, of Tonto Basin, owners of the Ord Quicksilver mine, who are treating the ores mined by leasers.

UTAH

Seek Changes in State Laws Affecting Leasing

Mill test for Cupric mine ore—Garfield smelter makes record production—Development loan for manganese property

▶ A number of bills have been introduced into the Utah State Legislature relating to non-ferrous metal mining. That of Senator George M. Miller would reduce the valuation basis for metal mines to the net proceeds of the year preceding the taxable year, compared with twice the net proceeds, now used as the basis for valuation. However, Senator Miller would double the 1 percent gross occupation tax.

▶ To boost production for the duration of the war, one bill proposes that the eight-hour "collar-to-collar" bill be amended. Labor representatives are fiercely opposed to this change, as they contend the "collar-to-collar" law would be permanently shelved. Operators are also interested in obtaining legislation which would clarify the status of lessors and lessees under the unemployment compensation law. Bills have been introduced defining employment as not including that service performed by lessees unless the lease agreement would through supervision and other controls, make an employee of the lessee.

▶ American Smelting and Refining Co.'s record-breaking copper production at the Garfield plant during January was celebrated on Feb. 2 at Barratt Hall with a victory production rally. During January, the Garfield plant produced more copper than had ever before been turned out by any one smelter in one month in the United States.

▶ Fred Staats, of Salt Lake City, has received a $20,000 mine development loan from the RFC for a manganese property near Joy.

▶ A mill test is being made of ore at the Cupric mine, near Milford, under the direction of J. A. Marsh, district engineer for the U. S. Bureau of Mines, in conjunction with the Desert Silver Co., lessee of the property. The Desert Silver Co. is running a drift to develop the Cupric orebody. The Bureau of Mines is also developing the Wah Wah lead-zinc mine and the Cougar fluorspar property. Tests of Cupric ore for tungsten content are being run at the Segerstrom mill.

▶ The Combined Metals Reduction Co. filed suit in the United States district court to recover $18,655.79 taxes paid by the company in 1938, 1939, 1940, and part of 1941.

NEVADA

Copper Company Reports Show Little Profit

Mill run on tin ore successful—Buck and Charley mill completed—Dayton dragline being shipped to Pennsylvania

▶ Consolidated Coppermines Corp. reported indicated net income for the fourth quarter of 1942, subject to audit and year-end adjustments, after estimated federal taxes but before depletion, of $244,153, compared with $115,946 for the comparable period in 1941. On the same basis, income for the full 1942 year was indicated to be $715,210 against $869,311 for 1941. A dividend of 20c. was paid in December.

▶ In its annual business statement for 1942, the Nevada Consolidated Copper Corp., Nevada division of Kennecott Copper Corp., shows cash balance at the beginning of the year $455,310.47; receipts for the year $18,155,211.62; expenditures $18,208,276.69; cash balance $402,245.40 at close of the year. The concentrator at McGill is reported treating up to 22,000 tons of copper ore per day, including 9,000 tons from Consolidated Coppermines properties.

▶ A recent mill run on 30 tons of 7.4 percent tin ore from the Greenan-Kerr tin-copper mine at Majuba Hill, Pershing County, produced 4 tons of concentrate and middling, shipped to a Metals Reserve Co. depot. The analysis report gave, for concentrate 67.45 percent tin, middling 27.36 percent, and tailing 0.8 percent tin. Concentrate from a smaller run assayed 71.55 percent tin. The combined shipments made approximately 5 tons of concentrate and middling, containing around 4,600 lb. of metallic tin. The U. S. Bureau of Mines will soon begin drilling in the area in which cassiterite has been developed, having secured allocation of $7,000 for this purpose, and a federal appropriation of $20,700 has been authorized for a road to serve the Greenan-Kerr and adjacent mines.

▶ Reports indicate that more than 20 tungsten properties in Nevada, ranging from new prospects to productive operations, have been accorded the "new-producer" rating that entitles them to receive the MRC bonus of $30 per short

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ton unit of tungsten trioxide. Largest producer, the Nevada-Massachusetts Co., will derive profit from new or increased production from its Golconda and Toulon units and its Long mine, to which a new road is being constructed by the federal Grazing Service. Other producers of note include the Getchell Mine Inc., M.G.L. Mining Co., United Tungsten Mines, Ltd., all receiving custom ores in agreement with the Metals Reserve Co., as well as several that are shipping to these plants or to the MRC stockpile center at Salt Lake City.

▶ Installation of a zinc concentrating unit has been completed in the reconditioned 75-ton flotation mill of the Butler-Rochester Mining Co. in Rochester Canyon, Pershing County. The property, the Buck & Charley mine, has been a producer of gold and silver and was operated by the Rochester-Plymouth Mines, Inc. John T. Butler and Edward H. Patterson, both of Pittsburgh, control the company and Kent Maher, of Rochester, is superintendent. Lead-zinc ore has been developed in considerable volume below the 200-ft. level.

▶ Vanadium ore from claims of the Argentena Consolidated Mining Co. at Goodsprings, Clark County, is being delivered by Fred B. Piehl, of Nipton, to a stockpile at the 100-ton Argentena mill, which is being equipped to concentrate the ore from the old silver-lead producer and from other claims in the district. The mill is to be operated by the Minerals Milling Co. through arrangement with Metals Reserve Co., brought about by Senator J. G. Scrugham, of Nevada. Willard E. Hales, of Goodsprings, is in charge of the mill.

▶ The Gilded Age Mining Co., operating in the Osceola district, southeastern White Pine County, and in late years the largest gold producer in that county, has closed down its gold mine, with a 1,200-ft. shaft, in compliance with the WPB order, and is developing two scheelite deposits near by. R. E. Margenau, of Ely, is manager.

▶ Scrap iron collected at points along the Southern Pacific Railroad in Nevada has been shipped, to the extent of several carloads, to the McGill smelter of the Nevada Consolidated Copper Corp., Kennecott subsidiary, in White Pine County. From this material balls are made to supply the large number of ball mills in the company's 20,000-ton flotation concentrator.

▶ The Dayton Dredging Co., with the nation's largest dragline gold dredge at Dayton, Lyon County, is dismantling its 850-ton Bucyrus-Monighan walking excavator unit, and has loaded on a flat car its three excavator buckets, two of 21-cu.yd. and one of 14-cu.yd. capacity, for shipment to the Correale Construction Co. at Pottsville, Pa. The 106x50-ft. washing plant has handled up to 10,000 cu.yd. per day.

▶ Following brief interruption because of storm-damaged roads, the Harold's Club Mining Co. has been operating its recently installed 35-ton Gould rotary furnace on cinnabar from its Red Bird mine and has leased the Nevada Quicksilver Co. mine in the Relief district of Pershing County, under direction of Ervin J. Young.

COLORADO

Climax Now Exceeding 18,000 Tons Daily

Denver Equipment Co. reopening Red Mountain mines—Four men drowned in Argo tunnel—Progress reported on Leadville heavy-density plant and Golden Cycle conversion

▶ Climax Molybdenum Co., of Climax, Colorado's largest mining operation, is now milling more than 18,000 tons per day. These are now more than 1,300 men on the payroll.

▶ Ralph E. Ruder, Box 1071 Colorado Springs, managing the Morning Star zinc-lead mine, near Whitepine, Gunnison County, will resume operations at the Hayden Mining Co. property this spring, when he can complete the road to the mine.

▶ Red Elephant Metals, Inc., has developed its mine at Lawson, sufficiently to keep three shifts operating in the mill. The ore is high in silver.

▶ The Paymaster groups of manganese claims, on Steuben Creek near Gunnison, are in production, and arrangements are being made either to erect a mill or contract for the milling.

▶ The Marcella mine, on Kendall Mountain, about one mile from the depot at Silverton, was discovered and partly developed more than forty years ago, but because of the high proportion of zinc ores in the mine it was allowed to lapse into idleness. According to reports, the deposit is about 50 ft. in width, and many samples showed over 40 percent zinc content. There are some values in copper and lead as well as in gold and silver. This property is now under development.

▶ George Rowe, managing the Mile High Mining Co., which operates the Smuggler mine, above Silver Plume, is producing some of the finest ore seen in this section for years. In addition to a large body of milling ore, the company has 4 to 10 in. of heavy lead-zinc ore which is impregnated with ruby silver, carrying approximately 1,000 oz. of silver per ton.

▶ Adolphus Butel, F. W. Pinkerton, and L. J. Brewer, of Durango, report the discovery of high-grade vanadium ore on Lightner Creek, with samples from 5 percent to nearly 8 percent V_2O_5.

▶ The new modern 1,000-ton heavy-density plant of the Ore & Chemical Co., being built at Leadville, to handle lead-zinc ores from dumps, is progressing rapidly despite the severe winter weather. This plant is under the supervision of Kurt A. Sphor. Construction work is being done by the Western Machinery Co. and the Western Knapp Engineering Co., with Mr. Wicker directing the construction work. Edward D. Dickerman, of Denver, engineer in charge of field work, states that the new plant will cost upward of a half million dollars. A contract has been made to lease the dumps of the North and South Moyer, Tucson, and R.A.M. mines. It is understood that the American Cyanamid heavy-media method will be used. The rough concentrate from this operation will be shipped to the Golden Cycle Corp. at Colorado Springs for finishing by flotation.

▶ Chief activity in the Georgetown area is centered in the recent reopening of the Mineral Chief, on Democrat Mountain, under the direction of E. P. Moe, who states he will be operating by spring. At present he is reopening the fifth and sixth levels.

▶ O. Barlow Wilmarth reports that the drift on the Grizzly, in West Argentine, has been reopened for a distance of approximately 800 ft. to a winze from which the water will be pumped. Both workings have a good showing of zinc-lead ores.

▶ The major undertaking in the Silverton area has been the restoration of old buildings and construction of additional housing facilities and working facilities at the Koehler tunnel, driven to open the well-known San Antonio and other mines near Red Mountain, by The Denver Equipment Co. Included in this undertaking is additional development of the Congress and Carbon Lake mines from the Koehler tunnel, which is near the top of the pass between Ouray and Silverton. Copper is the predominant metal in the properties. Access to the Congress mine from the Koehler tunnel will be by a crosscut which will cut the Congress orebodies at about the bottom of the 400-ft. shaft. This work will also drain the Congress workings. In addition to copper values the Congress has values in zinc and lead. The newer sections of the mine are to be worked from a shaft which is offset from the main shaft and was formerly bottomed at 150 ft.

▶ Charles Bennett, Claude Alberts, Sam Matris, and Louis Hamilton, all employed by the California Hidden Treasure Mining Co., were caught in the Argo tunnel, at Idaho Springs, when a shot broke through the workings of the Manmouth Kansas mine, releasing a torrent of water through the tunnel. Before the men could seek safety they were trapped and drowned. They were working in a crosscut from the main tunnel some 1,200 ft. and up 300 ft. from a point four and one-half miles in from the portal. They were attempting to hole through to the Kansas group, release the water and thus make available for mining at this time some bodies of base-metal ores. They were keeping a "hole ahead" of them as a precautionary measure, yet something went wrong and the water broke through. The force of the water must have picked the men up like chips of wood and carried them on the crest to the tunnel, where it made its way to the outside, washing out track and timbers and playing havoc with the mine cars and timbers.

▶ When the changes at the Golden Cycle mill, at Colorado Springs, are completed the plant will treat custom base-metal ores. Rehabilitation of the flotation section is nearly completed, and vice-president Max W. Bowen states he will be able to handle a maximum of three hundred tons of zinc ore per day. Capacity will be increased as necessary, up to 450 tons daily. Treatment of base-

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THE THOMAS LAUGHLIN Company PORTLAND, MAINE

metal ores is not new to the Golden Cycle Corp., as zinc-lead separation was done at the plant for a number of years, being abandoned in 1939.

▶ The Nora Lilly mine, north of Rico, will soon be reopened by Elizabeth Pellet. A small crew of men has been busy cleaning out the old workings, where cave-ins have blocked the passages since the mine was shut down 15 years ago. At that time there was some high-grade zinc-lead ore in the 40-ft. winze, and this ore will be mined first. The Nora Lilly mine, one of several owned by the Pellets, produced 8,000 tons of good ore in 1927.

▶ Edward F. McNees, holder of the Little Nation mine and 100-ton mill, at Howardsville, in San Juan County, is continuing development this winter on the Marmac Mining Co. property, in anticipation of having considerable ground opened for production during the summer months. The values are in zinc, lead, copper and silver.

▶ William Lonergan, pioneer prospector and miner, and associates from Texas are developing the Cincinnati group on Blair Mountain, less than a mile from Silverton. The new orebody, encountered at a depth of 600 ft. below the surface, is 125 ft. wide and carries milling values in copper, lead, and gold.

▶ L. E. Hanley, president of the Resurrection Mining Co. at Leadville, states that they shipped 8,000 tons of 40 percent zinc concentrates in 1942. This company, owned jointly by Hecla Mining, Newmont, and U. S. Smelting, is unwatering its property in the Iron Hill section of Leadville, and will soon be mining and milling a large tonnage of higher-grade zinc ore.

IDAHO

Slag Fuming Plant Near Completion

Legislature appropriates funds for mineral survey—Callahan Consolidated mill now operating—Senator Stewart mine to be reopened

▶ The new fuming plant of the Bunker Hill & Sullivan M. & C. Co., at Kellogg, in the Coeur d' Alenes, is nearing completion. It is a steel and concrete structure throughout and is an extension to the lead blast furnace building. It covers an area 180x340 ft., providing floor space of 61,200 sq.ft. The building is 53 ft. high and is served by a stack of brick 200 ft. high with an inside diameter of 10 ft. at the top. The plant is designed to recover both zinc and lead from hot waste slag from the lead furnaces of the Bunker Hill smelter. To this hot slag will be mixed a portion of the cold slag from the old smelter dumps, of which thousands of tons are available.

▶ The Idaho State Legislature has made an appropriation of $40,000 for a State mineral resources investigation to be used in cooperation with the U. S. Geological Survey. Dean Fahrenwald of the Idaho School of Mines is director of the State Bureau of Mines, which will have direction of the fund. A further study of mineral resources in the now famous Stibnite area of central Idaho is to be undertaken, as well as an investigation of mineralized areas in eastern Idaho.

▶ The new concentrator at the property of the Callahan Consolidated, near Wallace, is now in operation and reported to be making a satisfactory recovery. Delay in delivery of equipment retarded the work for several months. The mill will handle 100 tons daily of lead-zinc ore.

▶ The Champion mine, on Alder Creek, near Mackay, eastern Idaho, is preparing to market from six to eight carloads of ore per month, according to D. E. Bell and J. L. Ausich, of Mackay, who are in charge of operations. A new road has been completed to the mine and a new compressor installed.

▶ The Ima Mines Corp., operating a tungsten property at Patterson, in Lemhi County, shipped 113 tons of tungsten concentrates during the past year, according to W. P. Barton, general manager. In addition 607 tons of by-product sulphide concentrates produced in milling the tungsten was shipped to market. Diamond drilling by the U. S. Bureau of Mines is reported to have located new and extensive tungsten orebodies in the property.

▶ According to the report of the U. S. Bureau of Mines Idaho was again the largest silver-producing State in the Union for the year 1942. The State produced 26 percent of the total amount of silver mined in the United States. Montana was second, with 21 percent, and Utah third, with 19 percent. Idaho's output of silver for the year totaled 4,200,000 oz., a decrease of 2,472,390 oz., 15 percent, from the previous year. The Sunshine mine, in the Coeur d' Alenes, suffered a 35 percent decrease in output but still ranked the nation's top silver mine with 4,976,859 oz.

▶ The Whitedelf mine, near Clark Fork in Bonner County, has been leased to John M. McBride, of Denver, according to Congressman Compton I. White, principal owner of the property, under whose direction the mine has produced upward of 300 carloads of lead-zinc concentrates.

▶ The Senator Stewart mine, famous lead-zinc producer when owned and operated by F. Augustus Heinze, one of the trio of Butte copper kings in the period 1912 to 1916, has been acquired by Silver Bowl, Inc., of Kellogg. The property consists of 21 patented and unpatented claims, adjoining the Bunker Hill & Sullivan near Kellogg. During the Heinze regime more than $3,000,000 in dividends went to stockholders. Litigation followed the death of Heinze and production ceased, and the mine has been idle except for leasing operations since that time. Lester Harrison, Silver Bowl president, states an active campaign to reopen old workings and sink the main shaft to deeper levels will be undertaken. In addition a new vein system has been encountered in a crosscut recently driven north of the former workings. Reports state the vein is 23 ft. wide with commercial values in lead, zinc, and silver.

MONTANA

Mike Horse Company Making Good Output

Development proceeding at Tzarena manganese property—U. S. Vanadium shuts down Red Lodge operations—Manganese and lead-zinc mines being reopened

▶The Mike Horse Mining & Milling Co. is treating 190 tons of lead-zinc-silver-copper ore daily in the company's flotation mill at the Mike Horse mine, 19 miles east of Lincoln, in Lewis and Clark County. The mine is developed by three adits spaced through a vertical range of about 300 ft. These adits explore the vein to a depth of approximately 450 ft. The Mike Horse vein fills a steeply dipping fissure in diorite. The principal vein minerals are pyrite, galena, sphalerite, quartz, and chalcopyrite. The mine was discovered in 1898 and has been operated sporadically since its discovery. There are 125 men employed in the present mining and milling operations. Broken ore in the stopes is moved to the chutes by double-drum slushers. Square-set timbering methods are employed in the stopes. All ore is moved to one main haulage level by transfer shoots. Two battery-type locomotives are used to move the ore from the main haulage level to the mill. Compressed air for mining operations is supplied by one 75 hp. and one 50 hp. air compressor. Mine and mill are equipped with electric power. R. P. Porter, a member of Porter Brothers Corp., of Helena, is president of the company. Dave Mann is general superintendent, T. Pederson is mill superintendent, and Earl Hazelwood is mine foreman. The company offices are at Helena.

▶John Cole, of the Domestic Manganese & Development Co., of Butte, is proceeding rapidly with the development of the manganese orebody in the Tzarena claim immediately west of Butte. An electric power line has been completed to the mine and an electrically driven mine hoist and air compressor have been installed. The Ardsley Butte Extension headframe was purchased and has been erected over the 175-ft. Tzarena shaft. The shaft has been reconditioned, a crosscut has been driven to the Tzarena vein, and drifting is in progress in the vein. Preparations are being made to sink the shaft an additional 150 ft. The manganese orebody in the Tzarena claim has been diamond drilled by an exploration crew of the U. S. Bureau of Mines. Drilling operations were begun in May, 1942, and were completed on Jan. 20, 1943. Eighteen men are employed in the present development operation. The Tzarena was worked years ago as a silver mine. At that time little attention was given to the body of manganese ore to the west of the silver-producing area of the Tzarena vein.

▶The U. S. Vanadium Corp. has suspended mining operations on the Red Lodge chromite deposits in Carbon County. In 1941 the company acquired the

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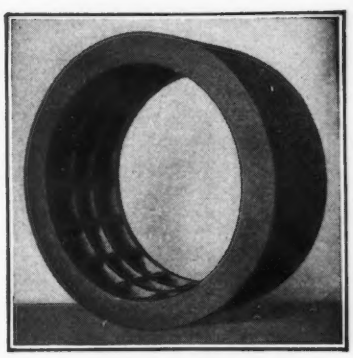

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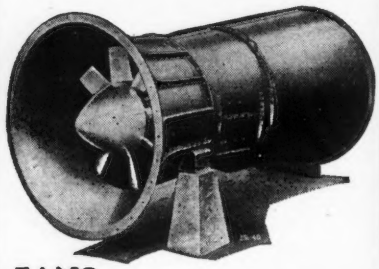

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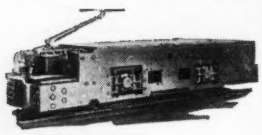
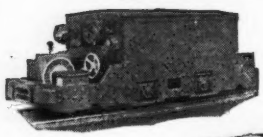
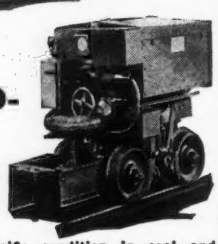




MINE LOCOMOTIVES



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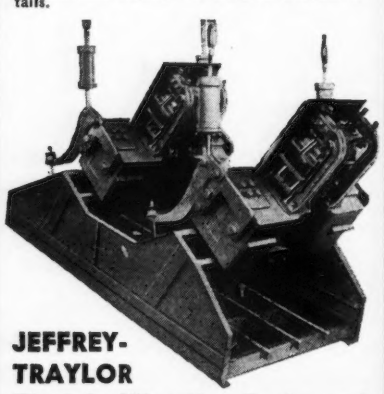

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COLUMBUS OHIO, U.S.A.

Highline, Hell Roaring, and Gallon Jug groups of mining claims from Montana Chrome, Inc. These claims covered a number of lenticular bodies of chromite in the gneissic rocks of the Beartooth Uplift on Line Creek and Hell Roaring Creek plateaus, some 10 to 20 miles southeast of Red Lodge.

▶ Broadwater Zinc & Lead Co. is opening up the old Iron Mask mine in the Park mining district of Broadwater County, 9 miles west of Townsend. A new 50-ton mill has been completed and is ready to go into operation. R. S. Stewart is manager of the operation.

▶ W. McC. White is opening his Minnie Jane manganese mine, about one mile west of Butte. Present operations are confined principally to rehabilitating the old mine workings and getting the property in condition for production.

▶ Clint Hanson, of Philipsburg, is making regular shipments of manganese carbonate ore from Philipsburg to the Metals Reserve Co., stockpile in Butte. The Philipsburg district has been a consistent producer of manganese dioxide ore for many years and normally supplies the bulk of the nation's battery-grade ore. This is, however, the first substantial production of manganese carbonate ore from the district.

OREGON

Proposal for New Steel Plant Near Portland

Heavy snow in Granite and Sumpter districts—Celebration mine has steady chrome output—New quicksilver operation planned near Gold Hill

▶ Earl K. Nixon, director of the Oregon Bureau of Geology and Mineral Industries, is proposing for the consideration of private or government capital a pig-iron or steel plant to be located near Portland. Eighty years ago 2,400 tons of pig iron was produced in a crude process from iron ore in the Oswego Hills near Portland. Portland soon will have two plants producing ferro-alloy. One is already being operated by Electrometallurgical Corp. The second, known as Oregon Electric Steel Rolling Mills, Inc., is expected to be producing steel from scrap iron within a few months. It is claimed there is 5,000,000 tons of iron ore in the Scappoose and St. Helens districts in Columbia County and a large tonnage in the Oswego Hills. The Scappoose limonite ore is said to assay in excess of 50 percent iron.

▶ The mining districts of Granite and Sumpter suffered from unusually heavy snow and cold weather in the past winter. At the Cornucopia mine, where Charles A. Sneddon was in charge, five persons remained at the mine through the winter. The snow was 105 in. deep and measured 33 in. of water. Because the Cornucopia mine was closed, the nearby town of Cornucopia, which in 1940 had 355 persons, was without an inhabitant.

▶ The Celebration chrome property, near John Day, has been producing an average of 25 tons a day, which goes into a government stockpile at Seneca. John F. Byram is in charge. He also expects to resume operations soon at the quicksilver property of the Bryam Oscar Co., at Prineville. He is president of the company and owner of the property.

▶ Western Minerals Product Co., of Marshfield, holds the Mountain King quicksilver property on upper Evans Creek, near Gold Hill. Marshfield men are backing the enterprise. F. B. Hickok, of Gold Hill, is manager, and expects to put the property into early production.

ALASKA

Legislature Asked to Make Mines Accessible

New highway in southeastern Alaska—Agitation to lessen severity of gold shutdown order

▶ M. J. Conroy, Anchorage attorney, has asked the Alaska Legislature to appoint a committee to confer with B. D. Stewart, Territorial Commissioner of Mines, to work out plans for developing small lode properties in the territory. The U. S. Geological Survey, under an appropriation made in 1930, investigated nine separate projects which Conroy says should be developed. They are at Fairbanks, Kantishna, Mount Eielson, Valdez Creek, West Fork Chulitna Creek, Willow Creek, Girdwood, Moose Pass, and the anthracite coal field of the Upper Matanuska valley. In all these districts, he says, are undeveloped prospects that could quickly be made productive except for the high costs of labor, food, transportation, and machinery, which are too much for the miner and prospector who desire to open their properties. Conroy says the new Alcan highway should make some of these properties accessible for development.

▶ Another highway has been started toward Fairbanks from Haines to provide a straight water-lane route which would open up much mining area in southeastern Alaska. Brig. Gen. James O'Connor is in charge and the Public Roads Administration has had three surveying parties working on the route. Officials believe they can keep the road open all winter.

▶ Alaska mining men are continuing their fight to get more favorable federal government consideration. Delegate Dimond and others are urging the attention of Congress and the federal agencies. They ask that small operators be permitted to resume work at least with the aid of men unfit for other war efforts. Governor Gruening and E. A. Rasmusson, president of the Bank of Alaska, with banks at Skagway and Anchorage, have been in Washington, D. C., pressing the claims of the Alaska miner. Already several small mining concerns have obtained permission to operate in a limited way if their operations do not interfere with the war effort or the labor supply.

WASHINGTON

Power Lack Bottlenecks Metaline Zinc Output

New report on state mineral occurrences —Orzada mine to resume operation—New zinc operation near Northport

▶The several government mining agencies which have offices in Spokane have been wrestling with the problem of providing additional power needed in the Metaline district in northeastern Washington if that region is to increase its output of zinc and lead, particularly zinc. One power plant on the Pend Oreille River is operating at full capacity supplying power for Pend Oreille Mines & Metals Co. and for the mining and mill operations of the American Zinc, Lead & Smelting Co.

▶Pend Oreille Mines & Metals Co. would like to secure government financial assistance to develop its Reeves-MacDonald property, north of Metaline Falls. This property is a large low-grade zinc deposit, and would require a new mill of about 1,000-ton capacity to make it profitable. In doing this the company would hope to get the premium on zinc, but, as most of the ore would come from the Canadian side of the line, it is doubtful that the premium price would be granted.

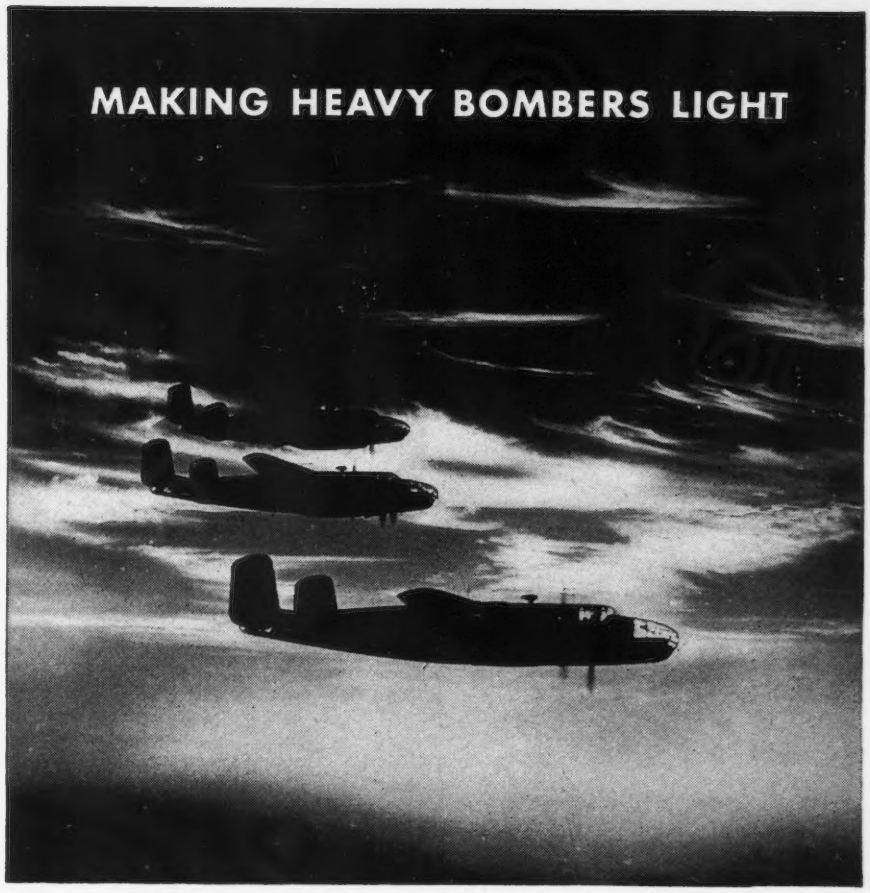
▶The RFC has examined various reported nickel deposits in this State, and one at Winesap, Chelan County, appears particularly attractive. Considerable development work has been done under Ernest N. Patty, one of the owners, who has had as many as 25 men employed. To handle his enterprise the Chelan Nickel Corp., of Seattle, has been formed with a capitalization of $100,000 by Mr. Patty, J. C. Bolinger, and J. A. Laughlin.

▶The State Department of Conservation and Development, Ed Davis, director, has issued a revised report on mineral showings in the State. It is a 36-page pamphlet and is put out under the direction of Sheldon L. Glover, supervisor of the State Division of Mines and Mining. It shows the location of 17 minerals in the State, with 6 showings of nickel.

▶Copper-bearing ore is being shipped from the Lucky Boy, formerly the Turk, and zinc-lead-silver ore from the old Cleveland mine, 15 miles north of Turk, in southwestern Stevens County.

▶West King Mining Co., of Spokane, intends to reopen its Orazada mine, in southwestern Stevens County, in order to furnish silica flux to the Tacoma smelter, according to Otto K. Quast, president and superintendent. He reports that recent work shows two orebodies. One is in a crosscut and the other in the drift at a depth of 300 ft.

▶Frank H. Mitchell, former manager of the Knob Hill mine, at Republic, is reopening the "Gorrien" or "New England" property, 4 miles east of Northport. The property contains zinc, which he has been exploring recently by diamond drills. He has built a small mill.



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TRI-STATE

Fire Destroys Rialto, Gordon Central Mills

American Zinc building mill near Aurora —Bird Dog mill now operating—Galena smelter employees oust CIO

▶ Early on Feb. 12, fire originating from an electric switch-box in the sludge room quickly spread to destroy the No. 2 surface property of the Rialto Mining Corp., a half-mile southeast of Cardin. The flames consumed the 75-ton-an-hour concentration plant, a large compressor building, a mine derrick, and a hopper. Ted Stith, of Miami, secretary of the company, reported the loss as in excess of $100,000. Although the loss was largely covered by insurance, it comes at a time when milling equipment and machinery as well as building materials and labor are difficult to obtain. Dr. A. G. Hull, of Joplin, is head of the mining firm, which also operates two other mining properties —the No. 3, a quarter-mile to the west, and the No. 4, a quarter-mile to the north. Approximately 185 men were employed at the three properties. Destruction of the compressor plant shut down operations at the No. 3 mine and loss of the mill forced the No. 4 mine to suspend operations. This effect, however, was only temporary, as the company immediately made arrangements to obtain air from a neighboring company, and ore from the No. 4 mine was shifted to the Royal custom mill of the United Zinc Smelting Corp., a mile southeast of Picher. The company now is rebuilding its compressor plant and constructing an unloading ramp and conveyor at its No. 3 mill, which will be put on a three-shift basis to treat ore from the Nos. 3 and 4 mines. Decision on rebuilding the No. 2 mill and derrick-hopper has not yet been made.

▶ Fire of undetermined origin early March 8 destroyed the large Gordon Central mill of the Federal Mining & Smelting Co., situated a mile from Picher, Okla. The mill was one of the three largest plants in the district, and was erected in 1937 at a cost of $150,000. Replacement value under present conditions would approximate $250,000.

▶ Work of constructing a 30-ton-an-hour mill has been started by the American Zinc, Lead & Smelting Co. on the Hunter land, a mile southeast of Aurora, Ralph E. Calhoun, of Joplin, district manager, reports. The new concentration plant is expected to be completed and in production within a four-month period. Preparations have been completed for the sinking of a new shaft on the Hunter land, beginning in March. Two 433-cu.ft.-per-minute Sullivan compressors already have been installed at the shaft site. The company is awaiting pump parts for the installation of two 7-in. Pomona pumps which will be installed to dewater the ground on the Hunter land, which was drilled out for a mill site some time ago. Two shafts have been completed by the company

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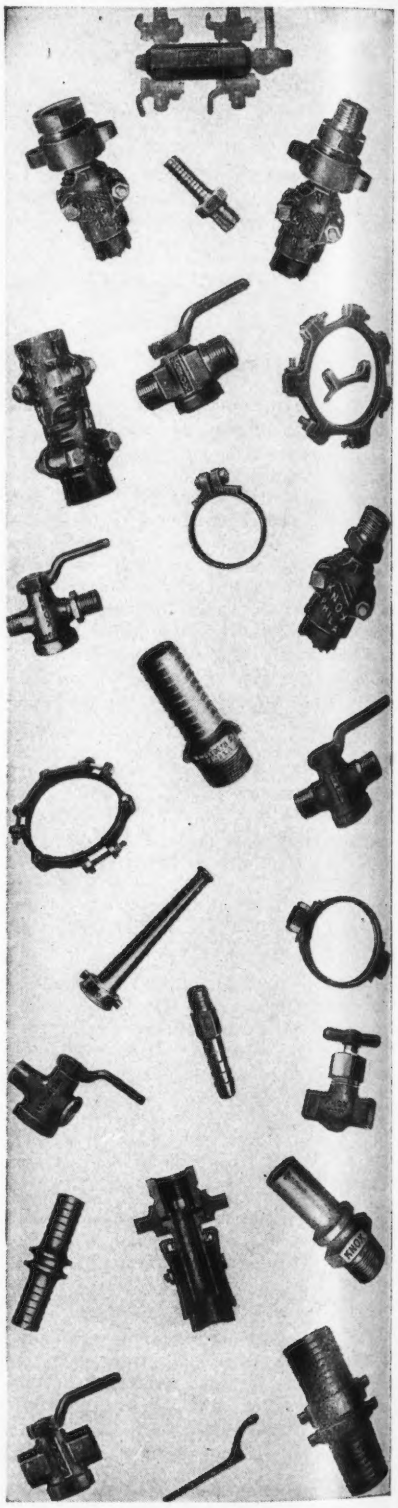

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at its new development on the Henckel and Smith land, two and one-half miles southeast of Duenweg, Calhoun said. Drifting operations have been started on the 170-ft. levels at both the No. 1, or north, Henckel shaft and the No. 1 shaft on the Smith land. The No. 2, or south, shaft on the Henckel land has been sunk to a depth of 112 ft., and will be continued down to the 132-ft. level. All units at both the Aurora and Duenweg developments are, or will be, electrically powered, including a turbine pump installed in each of the Duenweg shafts.

▶Eagle-Picher Mining & Smelting Co. has started its Bird Dog central mill, two miles west of Picher, and has begun pulling ore from the old Commerce West Side mill shaft, north of Picher in Kansas. The company is also treating ore from the Galena mines and the open-pit mine of the Oronogo Mutual Mining Co. at Oronogo in the Bird Dog mill. Ore from the West Side shaft, where a double-skip headframe and hoist have been installed in conjunction with a 1,000-ton steel storage hopper, is being shipped by rail to the Central mill. The West Side shaft, which was last operated by the Commerce Mining & Royalty Co. a number of years ago, features a motor-driven rotary mine-car dump installed by Eagle-Picher near the bottom of the shaft, according to G. C. Niday, of Miami, Tri-State manager of mining and milling operations for the company. This unit is the first of its kind to be installed underground in the district. The cars of ore are dumped mechanically by the rotor unit into underground skip-pockets, from which the ore is loaded by chutes into 2½-ton skips for hoisting to the surface. A railroad spur to the surface hopper was laid around the first of the year. Resumption of operations at both properties marks another advance in the company's efforts to expand and produce every pound of zinc ore possible to meet the great demands of the war. Previously the company launched an expansion program at its Webber, Foley, Velie-Leopard, Galena, Netta, and Paxson properties, in the last case as agent for Metals Reserve Co. Drainage of the Paxson property and other development work in that area are progressing satisfactorily and should be in production in the near future. The company has completed the rehabilitation of the Paxson mill, which has a capacity of 100 tons of ore an hour. A new feed-storage hopper of wooden construction has been completed in conjunction with the steel storage hopper at the mill, together with an incline and unloading ramp to the north. On the south side of U. S. Highway 166, the company has reopened an old shaft on the Swalley D, and has completed the sinking of a new one a short distance to the east on the Swalley land. A seven-inch Pomona pump has been installed for dewatering the west shaft, No. 1, over which a large wooden derrick and hopper has been completed. A similar hoisting and storage unit has been built at the east, or No. 2, shaft. A second new shaft has been started by the company southwest of the mill and north of the highway on the Stoskopf land. A

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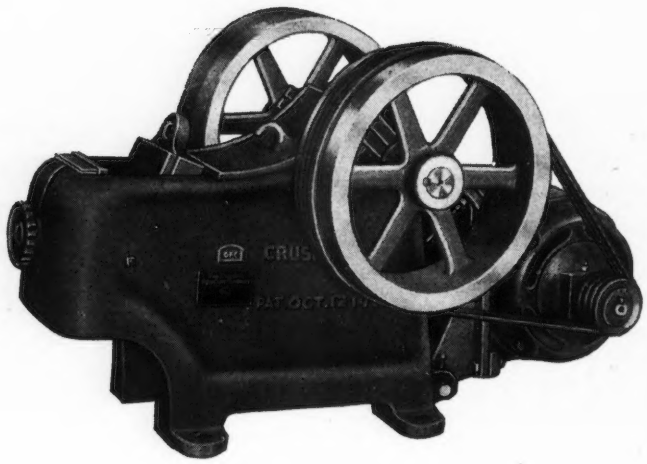

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sinking derrick has been erected and an airline has been extended to the new development. An 888-cu.in. Ingersoll-Rand and a 1,000-cu.ft. Laidlaw compressor have been installed on the Swalley land, and three 1,000-cu.ft. "I-R" units will be used at the old compressor plant just east of the Paxson mill. Mine operations, in this area from the 320- to the 340-ft. level, were last carried on at the Paxson property by the Commerce M. & R. Co. more than five years ago.

▶ In a NLRB election Jan. 22, Eagle-Picher Galena smelter employees voted, 89 to 61, against designating the International Union of Mine, Mill & Smelter Workers, a CIO affiliate, as their representative, or bargaining agent, in future negotiations with the company. Victory of the non-union group in the balloting was regarded as especially significant in view of the fact that the Galena local of the CIO had been regarded as one of the union's strongholds in the Tri-State. Much of the mine strike violence of 1935 and 1937, which twice brought Kansas national guardsmen to Galena and caused the city to be placed under martial law, centered at the Eagle-Picher smelter. The smelter and its employees also figured prominently in evidence at a prolonged labor board hearing in Joplin which followed the 1937 strike disorders. The union won the labor board case.

ARKANSAS

Republic M & M Awarded Army-Navy "E"

Bureau of Mines engineer reports substantial bauxite discoveries—Decline of Batesville manganese field anticipated—Hope for greater zinc production

▶ On Jan. 14, the Army-Navy "E" was presented to the Republic Mining & Manufacturing Co., at Bauxite, a subsidiary of the Aluminum Co. of America. Among the speakers at the colorful ceremony were Charles T. Evans, special assistant to the president of the Arkansas Power & Light Co., who acted as master of ceremonies; Col. Merle H. Davis, district chief, St. Louis Ordnance District; Frank B. Cuff, president of the Republic company; Roy A. Hunt, president of the Aluminum Co. of America; Thomas C. Jones, regional representative of Alcoa; Lieut. Commander Guy Stollenwerck, U.S.N., commandant of the Naval Training School, Memphis, Tenn.; J. E. Keene, president of local No. 23 A.W.A. (CIO); and Governor Homer Adkins.

▶ J. R. Thoenen, district engineer of the U. S. Bureau of Mines, has announced that 6,250,000 tons of bauxite has been discovered in Pulaski County. About 60 percent of this ore is said to be suitable for processing. Six drills are operating in Pulaski County and two more will be added. As soon as they can be built three drills will be added to those now in operation in Saline County. Delivery on these drills

is not expected for two or three months.

▶OPA has removed the phosphorus penalty from its ceiling price on high-grade manganese ore mined in the Batesville-Cushman field, and production has gradually increased since Feb. 20, the effective date. Ore can now be sold to any furnace not making ferromanganese that runs over 75 percent. During the last few months this penalty practically stopped the production of high-grade ore in the field.

▶According to reports, American Zinc Company of Arkansas, now buying low-grade wad ore for Metals Reserve, will stop purchases on March 31. When it opened this market the furnaces were buying a considerable tonnage of ore of this grade. In 1936, 37 and 38, the total amounted to 14,000 tons. The operators will ask Metals Reserve to continue the local market past March 31, until they regain their old furnace markets. American Zinc will continue to buy hard ore in the field after the wad market is discontinued.

▶Weather conditions during February and early March were favorable for mining in the field. There was little rainfall and all properties worked full time. The total production for February was 2,713 tons, the largest monthly output in the last year. Most of it was wad ore, purchased by American Zinc. The Aydelotte property, headed by Jack Gibbons, of Cushman, was first in output, making 1,000 tons of wad. Several new shafts came into production in February, which increased the average tonnage. Walter H. Denison Manganese Co., of Cushman, was second with 970 tons; 65 tons of this was high-grade, and 905 tons low-grade wad. Consolidated Mining Co., headed by Dr. Hoxey, with headquarters in Batesville, was third, with 665 tons, 10 percent being high-grade wad, and the rest low-grade. This company operates the Chin; and other properties operate in the Cave Creek district. It recently sunk an 85-ft. shaft on the Chin, which is now producing.

▶The Southern Hill Mining & Milling Co., headed by Berry Fitzgerald, of Batesville, is installing two more jig cells in the plant. The company operates the Southern Hill and Polk Southard mines near Cushman. The crude now milled comes from old dumps on the properties.

▶The first hydraulic operations in the field will be started sometime in February by the Par-Mar and E. & A. Mining companies. They are operating several properties on the Bayou about three miles from Batesville. James Wood, of Batesville, is engineer for both companies. Stanley Hanford, of Batesville, is superintendent of the E. & A. Assays of high-grade ore on the property run as high as 64 percent manganese and they expect their production to run from 55 to 60. Their hydraulic equipment is very powerful and they have two units installed. They expect to start operations about the middle of February. Water for the operations will be taken from the Bayou.

▶A hoist, a compressor, and air drills have all been installed at the Linsey Cave mine, in South Stone County, operated by Stanley K. Bourne, E. M. McGary, and A. H. Bohn, with headquarters in Batesville. A number of good faces of both carbonate and oxide have been found in the big cave, and a large tonnage has already been shot down. They are now laying track to remove it and continue operations.

▶Production in the north Arkansas zinc and lead field has not picked up during the last 30 days. Only one car was shipped during that period. This was a mixed car from the Excelsior and Moark mines. Indications are, however, that production will increase within the next two months.

▶The Hurricane Mining Co., operating the Hurricane mine, near Pindall, in charge of J. C. Shepherd, of Harrison, has completed an 80-ft. shaft on the big fault that runs through the property, and has encountered a good showing of ore.

▶The mill on the Ark-Ozark Co. property four miles northeast of Bellfonte, in Boone County, will not be completed for two or three weeks. J. E. Sawhill, of Harrison, is in charge of operations. He reports plenty of jack in sight to keep it running.

▶Ed Zimmermann, of Pittsburg, Kan., a pioneer operator in the field, has returned and taken a lease on the Maumee mine, at Maumee. Drilling operations are now in progress.

▶A. R. Seabass & Co., with Cleve Byrd in charge of operations, has completed some very successful prospecting operations on the Brewer and Baker properties at Ponca, in Newton County. The company has sunk one shaft to a depth of 170 ft. and reports some fine runs of ore. It went into the old Brewer tunnel, and sank an incline tunnel along the side of the fissure to a depth of 225 ft. and also reports finding ore in this operation. It has a large pile of ore on its dumps, and will make a test run on 500 tons of this at an adjacent mill in the near future. It expects to build a modern mill this year. The ore is galena, lead carbonate, and silicate zinc.

MICHIGAN

C & H Is Sinking New Allouez Shaft

Still negotiating for reopening of Centennial mine—Prepare to convert for amygdaloidal tailings re-treatment at Tamarack mill

▶Calumet & Hecla Consolidated Copper Co. has started the sinking of a new shaft near Ahmeek village, in Keweenaw County. Diamond drilling has revealed an area of mineralization in the Houghton conglomerate and overlying amygdaloids. The new shaft, in Allouez ground, will be known as Allouez No. 3. It will be extended to an inclined depth of 3,000 ft. or more. Capt. Howard McLeod, who has returned to Calumet & Hecla after several years as captain in the underground department of the Inland Steel Co., will be in charge of the shaft sinking. The shaft will consist of one hoisting compartment and a manway.

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Most of the surface plant will consist of buildings formerly used at Calumet Conglomerate and Osceola lode shafts. The mine and surface plant will be electrified. When ready for production, mine and surface plant will require 125 men. If the results of the diamond drilling on the conglomerate are verified by underground operations, the rate of production should reach approximately 1,000 tons of ore per day. The milling will require 30 to 40 men. Either the old Calumet Conglomerate mill or that of the Lake Mining, Smelting and Refining Co. will be used.

▶ Negotiations still are under way with the Metals Reserve Co. relative to the reopening by Calumet & Hecla of the Centennial mine, which has been closed since 1931. A decision respecting the property is expected soon.

▶ Calumet & Hecla's conglomerate tailings deposit at the Tamarack mill will be exhausted during the winter of 1943-44, according to the management. Adjacent is a large bank of low-grade amygdaloid tailings. Preparations already are being made for the treatment of these sands, which will require a change from the present method. The flowsheet will include closed circuit grinding using Akins classifiers and Forrester flotation machines. No leaching will be necessary. Alteration of the grinding mills, motors, and foundations, and erection of new flotation units, are being carried on without interruption to present operations. It is felt that the gamble is justified, considering the importance of prolonging the life of the company.

▶ Calumet & Hecla is rebuilding Hardinge mills for regrinding amygdaloid tailings, both for the new Quincy reclamation plant under construction and the Tamarack plant for use after the conglomerate sands are exhausted. The grinding must be cheap and fast. Hard iron balls will be used instead of pebbles. The greater weight of the balls calls for mills with bigger motors, gears, and bearings.

▶ E. R. Lovell, vice president and general manager of Calumet & Hecla, states that the company "will continue to pursue a vigorous exploratory campaign both by diamond drilling and underground work," and that "if we are permitted to obtain a decent price for copper, we feel that the future of the Michigan district is assured."

Eight Killed in Mine Accident in Wisconsin

EIGHT men were killed on Feb. 10 in the worst mine accident in the long history of the Platteville lead-zinc mining district, when the back of a low stope in the C.F. & H. mine collapsed, burying the men. The property, formerly known as the Mulcahy mine, is a mile west of Shullsburg, Wis.

Two of the men killed were buried in an initial collapse which occurred while they were preparing to shoot down a section of the back which was suspected of being weak. Six others were buried in a second cave-in which occurred whi they were attempting to dig out t bodies of the first two men.

IRON COUNTRY

Possibility Suggested of Hidden Ore Reserves

Butler Bros. drilling Mesabi deposits—Ne shaft for Pioneer mine—Hanna renew lease on Mesabi Chief

▶ Figures on the production of iron o for the year 1942 by companies revea that the Oliver Iron Mining Co. shippe as much ore from 21 mines as wa shipped by six other companies from 8 mines. These companies, in the order their total shipments, are Pickand Mather & Co., Cleveland-Cliffs Iron Co M. A. Hanna Co., Inter-State Iron Co Butler Bros., and Evergreen Mines C Following these concerns in tonnag shipped were Republic Steel Corp Oglebay, Norton Co., North Rang Mining Co., and Snyder Mining Co. Al of these concerns shipped better tha 1,000,000 gross tons during 1942.

▶ The S. E. Atkins Co., of Duluth, i operating two drills for Butler Bros., o Cooley, Minn., on two properties tha are under lease from the Niles Lan Co., of Duluth. One drill is on th Gilpin Reserve and one on the Gilpin Tehan, or Lenont Reserve. These tw properties are in Balkan Township eas of Chisholm, Minn.

▶ Prof. F. F. Grout, geologist of th University of Minnesota, recently pre sented a paper at a meeting of th Minnesota section of the A.I.M.E., i Minneapolis, regarding evidence of pos sible iron ore deposits between th Mesabi and Cuyuna ranges. His conten tions that the two ranges are geologicall correlated are supported by J. F. Wolf of the Oliver Iron Mining Co., Duluth As evidence of the geological link, th two geologists point out that the roc strata of the two ranges are the sam and occur in the same sequence. The granule textures of the iron-ore deposit are identical under the microscope, an the ore from the one range is very simi lar to that of the other. Professor Grout points out, however, that onl extensive exploration will determine th presence of ore deposits in this presen vacant area. One survey is now being made.

▶ The Oliver Iron Mining Co., of Duluth recently awarded the E. J. Longyear Co of Minneapolis a contract to sink an incline shaft at the Pioneer mine, a Ely, Minn. Surface subsidence aroun the collar has limited the mining area and the present demand for ore necessi tates relieving the shaft so that thi ore can be mined in the upper levels o the mine. The incline shaft will be sunk at 70 deg. in rock and will inter cept the present shaft about 750 ft from the collar. The new incline shaft will have two skips, a cage, and a pipe and-ladder compartment.

▶ The M. A. Hanna Co. has renewed its lease with the State of Minnesota on the Mesabi Chief mine, at Keewatin. The new lease calls for a royalty of 6¢

CANADA

Miners May Be Available for U. S. Employment

Possibility of reviving Cobalt district—May open Indian reservations to prospecting—Plan new mill for Silver Standard mine

▶An estimated increase of at least 25 percent over Canadian requirements is anticipated for 1943 in steel, copper, and nickel. Lower demand for structural steel is diverting many thousand tons of steel into the channels essential for ship building and munitions. When Parliament opened at Ottawa in the final week of January, the Speech from the Throne announced that maximum war production had been attained, indicating that no further expansion of war industry, particularly in the form of new construction, is being considered at present by the government.

▶With war industry at its peak and the completion of several major construction projects, including the great Shipshaw power development for the aluminum plant at Arvida, an increasing number of gold and base-metal miners are expected to be available for employment. The great majority of these employees are too old to be included in the category of married men from 20 to 25 years of age now being called up for the armed services. With this relief in sight for labor shortages in the mining camps it has been suggested that arrangements might be made for exporting experienced base-metal miners into the States to relieve some of the operating problems there.

▶Dr. George Hanson, assistant chief geologist of the Canada Geological Survey, has announced that field work this year is to be largely concentrated on oil and strategic minerals other than chromite. As it now appears that the United Nations in 1943 will have adequate reserves of chromium, the concerted search that was carried on last year for this metal will not be repeated. In other respects it is intended to continue last year's program of searching for deposits of those minerals that are critically needed for the war effort. In respect to tungsten, it was pointed out that the largest known concentrations of scheelite have been found in the Hollinger mine, in Porcupine. Numerous veins have been examined in various parts of the country, including upwards of 400 in the Yellowknife district of the Northwest Territories, but in most occurrences the tungsten content has been too low to be economic.

ONTARIO

▶Public announcement has been made of some of the results of a survey carried on last year by John A. Reid, consulting geologist and mining engineer, of the old Cobalt area about 100 miles south of Kirkland Lake. Sponsored by the Ontario Department of Mines, the report shows that considerable reserves of both cobalt and silver are available in the

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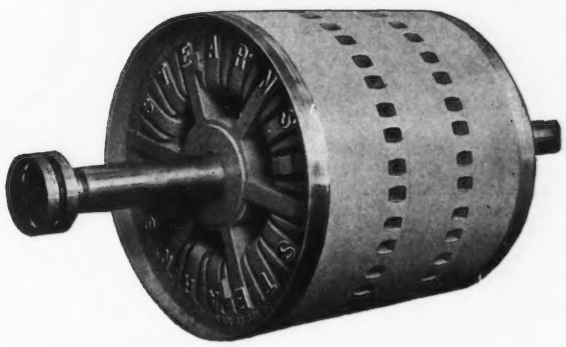

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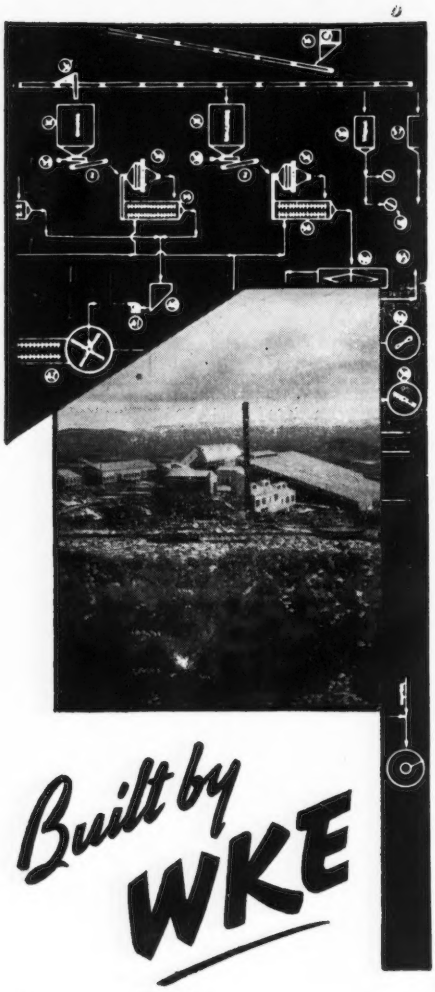

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new and partly explored areas in and adjacent to the Cobalt camp, where very limited prospecting has been done since 1908. There is believed to be reasonable possibility of finding new mines that might compare with the old Castle Trethewey, O'Brien and Keeley mines as the result of a program of intensive prospecting.

▶ In February two Ontario gold operators that recently shut down took steps to dispose of plant and equipment. Naybob Gold Mines, in the Porcupine camp, appointed a permanent liquidator to dispose of an inventory valued at $225,000. Wendigo Gold Mines, near Kenora, announced through its president, H. G. Young, that all plant and supplies on hand would be offered for sale and assets distributed to the shareholders.

▶ Cochenour Willans Gold Mines, in the Red Lake area of the Patricia district, has been consistently developing high-grade ore that has made the mine stand out as one of the most successful operations in Canada under present working handicaps. W. P. Mackle, mine manager, reports that an average grade of $50.19 a ton has been developed in the 319 vein on the third level, and two other ore zones in the new northeast section of the mine are showing exceptional promise in preliminary development. One of these shows an average grade of $35.42 a ton. It is stated that a large number of potential ore zones have been located by diamond-drill holes and await investigation. In 19 months of operation, to Dec. 31, output amounted to $1,841,100, of which $1,003,466 was operating profit. In the last seven months of last year, mill feed for the 160-ton mill averaged $21.65 a ton.

▶ A new production level was achieved by Leitch Gold Mines in the last three months of 1942. Grade advanced to $34.38 from the $32.42 a ton for all of last year and compares with $29.34 in 1941. Production last year amounted to $975,183, of which $309,623 was net profit after taxes, depreciation, deferred development written off, and write-offs for outside exploration.

QUEBEC

▶ Operations at Perron Gold Mines are being seriously threatened by the labor shortage. A payroll reduction from the normal 340 men to 220 has led to a reduction of 100 tons daily in the quantity of ore hoisted, and the mill rate has been cut about 50 tons a day. Since first production in 1936 the mine has recovered gold valued at more than $10,000,000 and has paid dividends of about $1,740,000. At present the only producing gold mine east of the Siscoe-Lamaque camp, Perron supports a community of some 1,000 people. The general manager, J. P. Norrie, reports that ore reserves have been maintained during the past year, although some concern is being felt for the lack of important ore disclosures from the new deep levels that have been opened since the completion of the No. 5 shaft to 2,125 ft. The flat-lying No. 32 vein, which has supplied as much as 50 percent of the mill feed in the past, has not been productive below 1,375-ft. horizon and no other similar orebodies are being encountered.

TIN PRODUCERS

OPERATORS of tin properties in Malaya, Bolivia, Nigeria and the Belgian Congo have increased recoveries substantially in the past two years with the help of Pan-American Jigs and Pan-American metallurgical service.

Today the war makes increased tin production a vital necessity. Pan-American Jigs and metallurgy may be able to give you invaluable help in raising your output.

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820 PARKER ST., BERKELEY, CALIF., U.S.A.
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Design, Metallurgical Testing and Field Consulting Service; Manufacturers of Mill and Placer Recovery Equipment.

▶Improved operating efficiency is being initiated by the new manager at Francoeur Gold Mines, J. W. McKenzie, in an effort to lower working costs from the level of $4.89 a ton prevailing last year. A new ore-pass system is designed to carry all ore down to the grizzly station and loading pocket on the third level, and an ore conveyor has been installed to connect mill and headframe, eliminating the haul by truck that was formerly employed. In spite of the 10 percent reduction in ore reserves last year, the No. 8, or east, ore zone has responded well to development and now gives promise of further extension.

▶Normetal Mining Corp. has been able to maintain capacity output of copper and zinc concentrates, although hampered by labor shortages, as reported by the president, J. H. C. Waite. Output last year was stated to be 22 percent higher than in 1941. Development is making satisfactory progress on two new levels.

▶Beattie Gold Mines, largest of Canada's three arsenic producers, is continuing diamond-drilling exploration along a 10,000-ft. section of the main porphyry contact as a part of a long-range program. Though ore reserves of almost 4,000,000 tons were closely maintained during the past year, normal operations were hampered by a mud slide that took place last June in the glory hole. This tied up an estimated 135,000 tons of good grade ore which will be inaccessible until the remaining two-thirds of surface material has been removed either by truck or down through the mine workings. To safeguard the large open stope against a recurrence of the landslide, it is planned to carry away about 200,000 yards of glacial material above the north wall of the opening. Jay Tuttle is mine manager.

BRITISH COLUMBIA

▶The Mining Association of British Columbia has reelected T. W. Bingay president for 1943; H. P. Wilson and H. T. James are vice-presidents; and the directors consist of A. S. Baillie, C. P. Browning, J. A. Clark, V. J. Creeden, H. E. Doelle, W. C. Douglass, F. W. Guernsey, A. M. Ham, A. E. Jukes, W. R. Lindsay, D. N. Matheson, H. R. Plommer, R. R. Rose, B. F. Smith, R. H. Stewart, and D. S. Tait. H. Mortimer-Lamb and W. Russell Watson were reappointed secretary-treasurer and auditor respectively. The association will present a brief to the British Columbia legislature opposing the present adoption of proposed amendments to the Industrial Conciliation and Arbitration Act which would compel collective bargaining in a manner similar to the procedure provided in the Wagner Act, now governing in several of the United States.

▶The Special Joint Committee of members of the Vancouver City Council and representative citizens, appointed to investigate the feasibility of establishing an iron and steel industry on the Pacific Coast, has presented a long brief before the Cabinet of the Hon. John Hart, Premier of British Columbia. The brief condemns both federal and provincial mines departments for failure to provide consistent estimates of iron-ore and cok-

Amsco Dippers Help Answer the Call for More Copper . . .

The many munitions made from copper-base alloys necessitate an increased output of copper. Here, as in other industries, adequate production depends largely on the stamina of the equipment employed. The dippers used in copper mining must be able to stand up under heavy pressures and high speeds for long periods. A shovel out of service for lack of a serviceable dipper means a great output loss; and production time is *one of those things that don't come back.*

Amsco dippers, designed for the specific job and made of austenitic manganese steel, are giving dependable service in some of the largest open pit copper mines, helping to maintain the tonnage of copper required by the nation's many munitions plants.

Illustrated below is an Arizona open-pit copper mine, where fifteen Amsco 5 yd. renewable lip dippers are in service, part of more than fifty used in similar copper mines. One of the latest of these buckets shows in photograph R-780. The shape was influenced by the nature of digging, height of banks and dumping height. Width, lip shape and tooth spacing were dictated by the comparatively short booms of modern high speed shovels, and meet the requirement of full filling with short travel by offering minimum digging resistance.

Being made of "the toughest steel known" and having sufficient metal at points of severe abrasion, these manganese steel dippers function for long periods in abusive service. Additional life, as well as conservation of metal, is contributed by the renewable lip feature.

Amsco Dipper Bulletin No. 641-D will be mailed on request.

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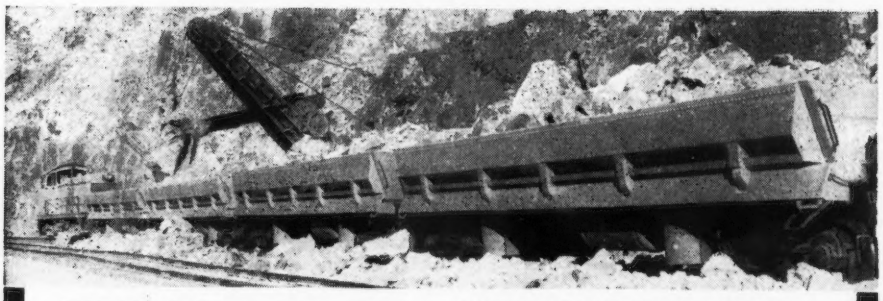

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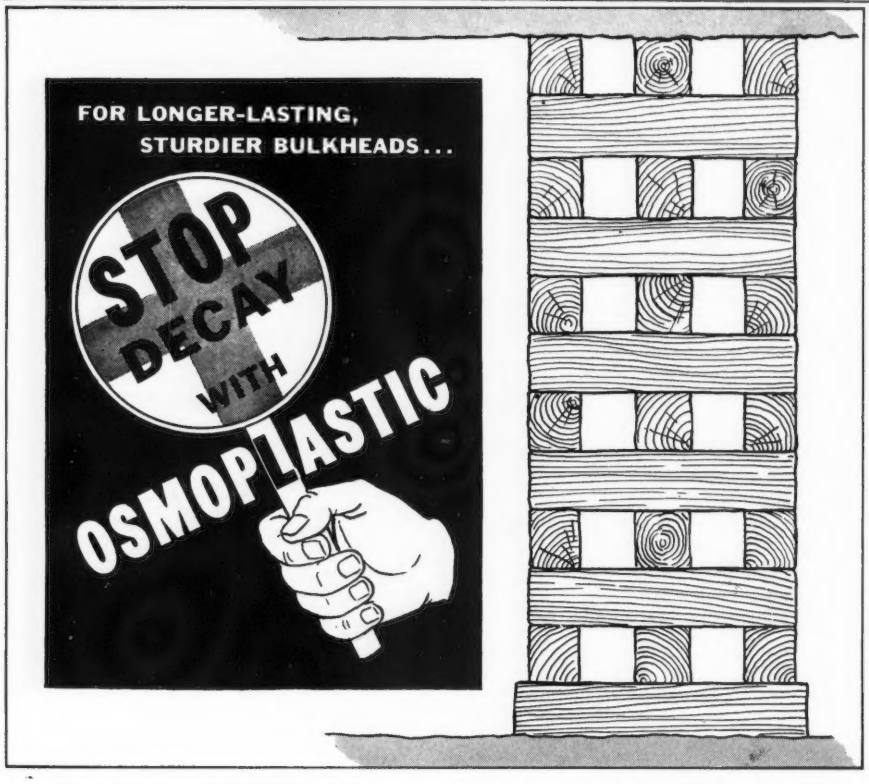
STOP DECAY WITH OSMOPLASTIC



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The cost of this highly effective wood-preservative is surprisingly small... yet, in many leading mines throughout the nation, *experience* proves that OSMOPLASTIC has added many extra years of service life to bulkheads, timber-sets, car flooring, ties, shafts and tipples.

Mail the coupon now, and find out how to protect your mine timbers *today* from *decay* tomorrow... with OSMOPLASTIC!

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ing-coal reserves, both of which have been quoted at widely varying figures. The establishment of an iron and steel industry is being urged both as an immediate undertaking to assist the war effort and as an industry of paramount importance in the rehabilitation period following the war. The committee reports a sympathetic hearing from the government.

▶ The Prospectors and Developers Association, with head office at Toronto, is holding a series of meetings across Canada to provide new instruction in the search for strategic minerals. The principal contributions are papers by the geologists of the Geological Survey of Canada, the various Provincial Departments of Mines, and in Vancouver by members of the staff of the University of British Columbia. The lecture series, recently in session in Vancouver, includes papers by W. E. Cockfield, H. C. Gunning, J. W. Ambrose, J. F. Walker, H. S. Bostock, M. S. Hedley, J. S. Stevenson, A. W. Jolliffe, and M. Y. Williams.

▶ An agreement between the Dominion and British Columbia governments, whereby Indian reserves in this province will be opened for prospecting, will be introduced at the present session of the Legislature for ratification. In the past these areas have been closed, and although the natives have shown little enterprise in developing the mineral potentialities, prospectors have been denied entry to search for mineral deposits thereon. Under the arrangements in this agreement, Indians will share in any benefits that may accrue. The Dominion government, as guardian of the Indians, has agreed to the administration of mining on reserve lands under the mineral laws of the Province of British Columbia.

▶ Selkirks Tungs-tin Mines, Ltd., has been granted a Dominion charter and will proceed with the development of the Woolsey mine, in Albert Canyon, in the Revelstoke mining division. The mine is a former gold and silver producer, but has recently attracted attention because of a high-grade orebody containing both cassiterite and stannite.

▶ During the last quarter of 1942, Hedley Mascot Gold Mines, Ltd., milled 15,217 tons of ore; average heads were 0.363 oz. gold per ton. Net income after provision for taxes, development, and exploration was $51,518.41 and net earnings per share before depreciation and depletion were 2.24 c. In the company's quarterly statement shareholders are advised by Dr. Victor Dolmage, consulting geologist: "At the time of the last quarterly report, operations, particularly exploration, were suffering from an acute labor shortage. This situation has improved greatly and operations are again nearly normal. It was stated in that report that in order to maintain production it had been necessary to draw on broken-ore reserves. Since then it has been possible, besides maintaining production, to replenish these reserves to their normal amount. Exploration during the period under review has been limited to some diamond drilling from the 4,300 level in the southwest corner of the claim. A favorable structure has been predicted in this locality and the drilling has confirmed its existence and shown it to contain, in this locality at least, important orebodies. The structure

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extends east, probably as far as the eastern boundary of the claim, a distance of 600 ft., and will be systematically explored throughout." Since the granting of labor priorities to the Hedley mines, on account of the production of arsenic as a byproduct, operations at both the Hedley Mascot and the Kelowna Exploration have returned to close to normal.

▶ January production of Cariboo Gold Quartz Mining Co., Ltd., was 1,969 oz. gold, valued at $75,806, from 5,725 tons of ore milled. For the company's fiscal year ended Jan. 31, 1943, the value of production was $1,335,254 from 88,689 tons, averaging 0.39 oz. gold per ton, a decline of more than a half million dollars from the preceding year. During the last six months there has been scarcely any operating profit, and the last quarterly dividend was paid from earned surplus.

▶ A new mill is planned for the Silver Standard mine, near Hazelton, in the Omineca mining division. The property and existing plant have been purchased by Clifton C. Cross and Co. (B. C.), Ltd., which firm is now negotiating with the Metals Controller's office with a view of resuming the production of lead and zinc in the near future. The mine operated continuously from 1914 to 1922, when it produced approximately 2,000,000 lb. zinc, 1,000,000 lb. lead, 500,000 ozs. silver, and 1,000 oz. gold.

▶ Twin "J" Mines, Ltd., recently incorporated subsidiary of Jason Mines, Ltd., former Ontario gold producer, has encountered unforeseen handicaps in the preparation of the Tyee copper-zinc mine, in the Victoria mining division, for production. It had originally been planned to have this property in production by March of this year, but Col. E. M. Thomson, president of both the Twin "J" and Jason companies, advises that many difficulties, particularly that of blocked transportation as a result of deep snow on Vancouver Island, will make it impossible to have the mill in operation before June. The project is being financed by Wartime Metals Corporation, Dominion government subsidiary and Canadian agent of the Metals Reserve Co. Jason Mines, Ltd., has been registered provincially and is investigating several strategic-mineral prospects.

YUKON TERRITORY

▶ During 1942 The Yukon Consolidated Gold Corp., Ltd., produced gold to a greater value than in any former year. Despite the labor shortage, stripping was advanced at seven places, 2,952,781 cu.yd. of overburden being removed at a cost of $174,285, equivalent to 6.967c per cubic yard. The reserves of stripped ground were reduced by 5 percent. Thawing operations were also conducted at seven places, covering 4,529,117 cu.yd., at a cost of $202,648, or 4.74c per cubic yard. Reserves of thawed ground decreased by 28 percent. The plentiful supply of moisture during the latter part of 1942 indicates a favorable opportunity for recovery in 1943. All ten dredges operated throughout the season, mining 10,401,000 cu.yd. of ground. The extension of the Sulphur-Australia ditch on Upper Sulphur Creek was the only capital expenditure of importance.

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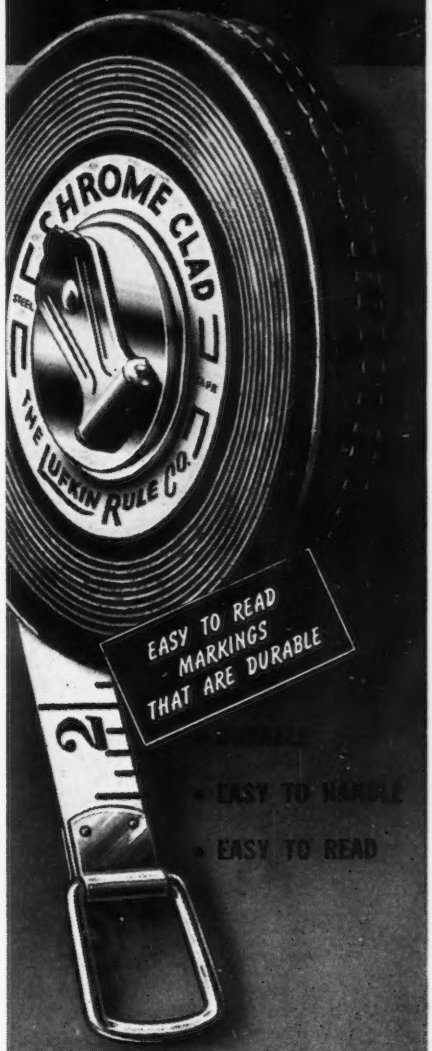

Engineers appreciate the many advantages of the Lufkin "Anchor" Chrome Clad Steel Tape. Jet black markings are easy to read against a satin chrome surface that won't rust, crack, chip or peel. Genuine leather hand-stitched case on a plated steel liner is exceptionally durable. Folding flush handle opened by a push pin and smooth winding mechanism make it easy to use. For general measuring work, the Lufkin "Anchor" simply can't be beaten. Write for free catalog.

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Mineralight lamps have helped locate over $100,000,000.00 worth of Tungsten ore. Typical prospects are listed in the box at the right. You, too, may have valuable deposits that should be checked. They may mean great hidden profits for you – vital supplies of Tungsten for war industries.

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DON'T OVERLOOK THESE PROSPECTS

Miners, prospectors – here are some typical examples of where Tungsten may be found. Examine such locations carefully –

All limestone – granite contacts
All mineralized zones including mining operations of –

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MEXICO

General Mining Strike Averted

Old mines reopened in San Luis Potosi—Strike called against Cia. Minera La Victoria—Seek to expropriate Jap interest in fluorite mine

▶ Mining in Mexico continued to do well in midwinter with regard to its operating and export phases, both of which are definitely on the uptrend, and the threat of a general mine strike has been lifted. The projected strike on the part of the miners' union against 67 major companies was first threatened for Jan. 29 but was postponed upon the intervention of President Camacho until Feb. 28. The union objective was a 25 percent wage increase, but, with active government participation in the settlement, differences were finally patched up at the last moment with a 10 percent increase, when Kildun, the last hold-out, yielded. Included in the settlement was the dispute affecting Cia. Minera Real del Monte y Pachuca, to which the cost was reported at 4,000,000 pesos ($825,000) for two years.

▶ The railroad car situation, so far as the National Railways, Mexico's government-owned railroad, is concerned, that is sharply affecting several industrial and agricultural sectors, has not seriously bothered the mining industry. At least, no complaints of a car shortage have been heard lately from mining.

▶ A test case of whether or not state governments may tax mining companies on production is seen in the appeal to the Federal Supreme Court by the Cia. Estanera, S. A., working tin deposits near Durango City, from the dismissal of its injunction suit to restrain the Durango government from such taxation by the First District Court of Durango. The company contends that the constitution gives the federal government the exclusive right to tax mine production.

▶ Miners are among Mexico's highest-paid labor, as is shown by official figures reporting that five years ago only 20 per cent of the membership of some 80,000 claimed by the national miners union paid the income tax (starting at 167 pesos a month in Mexico), whereas at present 70 percent of the miners are paying this impost. That means that most miners are earning more than 5.76 pesos a day, a very high wage for Mexico.

▶ Mexican coal is now being used exclusively by Cia. Minera de El Boleo, S. A., Santa Rosalia, Baja California, a French-owned copper mining enterprise. It is obtaining this fuel at Tonichi, Sonora, and has just taken delivery of 2,000 metric tons. Boleo formerly used American coal, but the war obliged it to look to Mexico for these supplies. Both fuel and deliveries are said to be entirely satisfactory.

▶ Resumption of work in many silver, zinc, lead, and mercury mines in the Guadalcazar sector, San Luis Potosi, some of which had long been abandoned

nd others worked only occasionally, is eported by the National Commission for timulation of the Mining Industry. War emands for their products caused this esumption of work. Some of these mines re as old as 400 years.

▶Transportation difficulties for mining n the zone between Parral, Chihuahua, nd Durango, have increased with the etition to the federal government by he Parral and Durango Railway for anction to suspend operations. The rail-ay made a similar petition last May, ut the government induced it to carry n in the hope that its business would mprove. The company now declares that t is impossible for it to continue, because t is completely bankrupt.

▶Payment of indemnifications totaling 8,265.34 pesos ($6,100) to 18 former employees for disability has been made y Potosi Mining, Chihuahua.

▶Settlement of a labor dispute by the ederal Board of Conciliation and Arbi-ration that involved the American-owned ia. Minera Amparo, S. A., at its Monte le San Nicolas, Guanajuato, is seen as ndicating a new trend of the Mexican overnment toward the mining industry. The board made a careful investigation of the company's contention that it must top work at this unit because it is un-profitable, and found the statement to be orrect. It induced the company to con-inue working at Monte de San Nicolas on the basis of a moratorium for two ears on the payment of the miners' wage and other claims. The board induced the miners' union to waive its privilege to protest this arrangement and has told the Amparo employees that it will pena-lize them if they make demands for pay-ment of their claims before the end of the two years.

▶Chihuahua has acted to protect pros-pectors to the extent of punishing those who disrupt or forbid their work. The State explains that prospectors must be protected, as they are valuable in ex-ploration in the mining industry and in exploitation of tracts that, although rich, are too small for large operators to mine.

▶A strike has been called against the Cia. Minera La Victoria, S. A., Cosala, Sinaloa. The workers aver that they were obliged to strike because the com-pany has refused to abide by an agree-ment made with them in February, 1941, with the approval of the Labor Ministry, which permitted cuts in pay and person-nel until the firm's business improved. The strikers declare that the company's economic condition has been greatly im-proved by the war demand for its prod-ucts but that it insists upon continuing the reduced wages.

▶"La Azul" mine, a fluorite producer at Taxco, Guerrero, is the object of an in-junction suit filed in the Second District Court, Mexico City, by Frederick De-schamps, who asserts that he is working the property under lease from one of its owners, Pastor Rodriguez, for a con-sideration of $8,000 (U. S.). The suit is to set aside orders of the Enemy Aliens Properties Control and Vigilance Board that the mine be directly operated by it because some of the owners are Japanese. Some time ago, the national miners' union urged the federal government to expropriate this property, citing Japa-nese ownership as the reason, and give it

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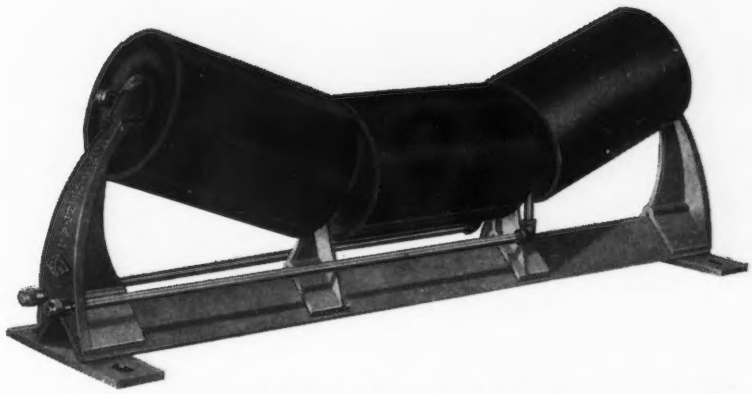
BELT CONVEYOR IDLERS



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(A) Right and left-hand threads make possible minute adjustments of bearings.

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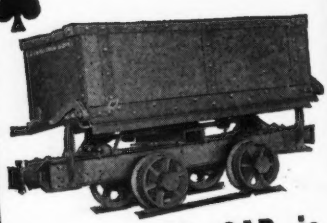

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Covers cars, trucks, wheels, rope haulage equipment & trackwork.

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Weighing and sampling Bolivian tin concentrates for shipment to Texas smelter

to its workers to conduct cooperatively. The government still has this petition under consideration. The union charged that the Japanese have a large amount of fluorite frozen to prevent its shipment to the United States.

BOLIVIA

BEW Strives to Raise Tin Production

Compania Cerro de Potosi installing Tainton plant—Sink-float unit of Catavi plant now operating—Canutillos mine is increasing mill capacity

▶ The United States Board of Economic Warfare, with its special representative, Phillip Kazen, as its head in Bolivia, is undertaking a vast plan to increase tin production, through various means, being carried out by the minerals mission of the BEW to Bolivia. Under BEW, sampling of several tin and tungsten deposits has been started. On the basis of this preliminary work, a program of development and operation will be made for those properties which offer probabilities of exploitation. "Ocurf" and other tin placer deposits are being drill-sampled, using Empire drills.

▶ The Board of Economic Warfare plans to extend to all Bolivian mines in need of technical advice, the benefit of the services of its staff of mining and metallurgical engineers, to study the mines and elaborate plans for their development. So far this service was handled, but on a very reduced scale, due to lack of personnel and equipment, by Banco Minero de Bolivia and Dirección General de Minas y Petróleo.

▶ There is a belief among people who know the operation of Bolivian mining industry, that with relatively small expenditures in machinery, mainly for mineral beneficiation, and adequate technical advice, medium- and small-sized mining enterprises may produce an average of at least 15 percent more than at present; and some of the properties, given the means, become big producers, as can be expected from experience.

▶ To obtain practical results from the work outlined in the foregoing, the BEW will help to finance the enterprises under consideration, and obtain the priorities for the supply of equipment and reservation of shipping space for its transport to Bolivia.

▶ The minerals mission is also keeping track of the loans made by Metals Reserve to Bolivian mining enterprises.

▶ Head of the minerals mission is William W. Tamplin, and already at work in Bolivia, are the metallurgical engineers, Ernest Overbillig, Francis Devereux, H. Rush Spaddon, Arvid Thunaes, and Abbott Rewick, and the mining engineers, Lloyd J. Severson, Archibald Hazard, and B. Arnold. John Worcester, minerals attache from the U. S. Department of State, is also working in connection with the BEW.

▶ Compañía Unificada del Cerro de Potosí, through working old mill tails and rich mine-fills in the last months, has increased production to more than 300 tons of fine tin monthly. Also on

this Hochschild property, work is being continued to install a Tainton-process plant.

▶The sink-and-float plant for the Patiño Mines' Catavi tin concentrator—the biggest of its kind in the world—has been put in operation.

▶In Canutillos, a new Patiño mine, installation of a mill to increase production of 30 percent tin concentrates to 100 tons fine per month is being completed.

PERU

Improved Prospects for Mica Development

Santa Helena copper mine to start soon—Calpa mine plans to produce copper-gold ore—La Suerte antimony mine has new concentrator

▶The mica industry in this country will at last have the opportunity of becoming important with the new list of prices that Metals Reserve Co. is about to publish. The purchase of mica by Metals Reserve will actually be the first definite step towards development, as owners of mica properties have never been able to find either reasonable prices or a steady market. Besides, the grading of mica has always been a great problem here. The new prices are the highest in mica history, and Metals Reserve will have experts to classify the mica. The mica deposits are all in the coastal sections of the Department of Arequipa, in Southern Peru. Mica occurs in pegmatite dikes, and some deposits appear to offer excellent possibilities. Recently Metals Reserve Co. made electrical tests with several South American micas. Some did not stand the tests, but Peruvian mica proved to be of excellent electrical quality.

▶The Santa Helena mine, recently acquired by Mauricio Hochschild & Co., and located in the Department of Ancash, is to start operations soon, with the installation of a 50-ton concentrator. Ore is said to have 7 percent copper and about 20 oz. of silver. This mine was developed by the former owners several years ago.

▶The Calpa mine, belonging to Compañía Aurífera Caravelí, S. A., in the Department of Arequipa, is getting ready to exploit its reserves of copper-gold ore. Calpa has been for several years strictly a gold producer, but is now changing to copper. The ore averages 2.4 percent copper and 0.5 oz. of gold.

▶A small concentrator has recently been erected in the La Suerte antimony mine, in the Department of Puno, near Lake Titicaca. The mine has been operating for the last seven years. With the new concentration plant production of concentrates has been increased from 14 to 50 tons a month. Besides containing about 50 percent antimony, concentrates carry from 7 to 10 oz. of gold per ton. Reserves are said to be large.

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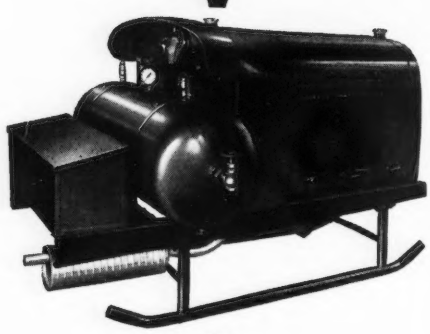

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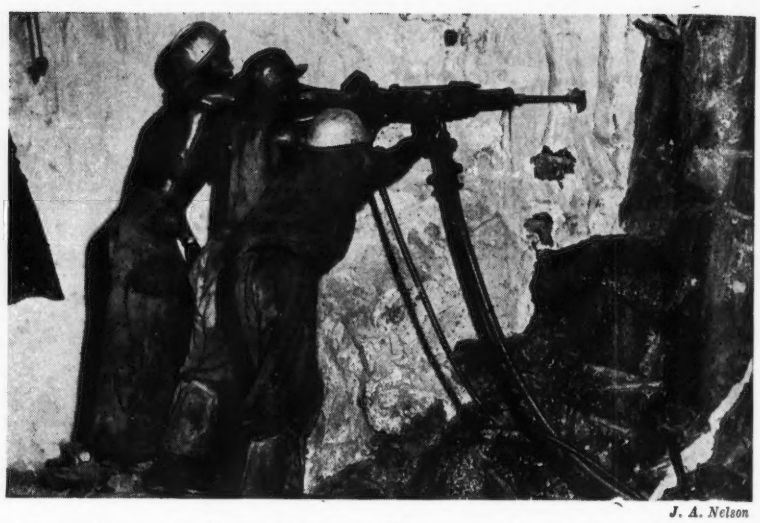


J. A. Nelson

Extra help on an awkward hole in a Witwatersrand gold mine. Note gunite on walls

AFRICA

Mufulira Shows Profit Despite Handicaps

All Rhodesian coppers show low costs—Rand records some decline—Cam & Motor has new orebody

▶ The appearance of the reports of the four Northern Rhodesia copper producers has brought a surprise. It is that Mufulira Copper has taken the leadership of the group in both production and operating profit. Its sales of metals came to £4,009,978. Operating expenses were 54 percent of this, or £2,168,017. As its copper was sold to the British government for the equivalent of about 8c., the indicated cost of production was about 4¼c. a pound before depreciation and taxes. Rhokana's results were very nearly the same, metal sales being £3,997,906 and operating expenses 59 percent of this, or £2,377,401, indicating a production cost of about 4⅜c. Roan Antelope's metal sales came to £3,266,594.

Operating expenses were 59 percent of sales, or £1,934,784, indicating a copper cost of about 4⅜c. The foregoing costs are exclusive of depreciation or taxes. Operating profits of the three companies were £1,841,967, £1,791,125, and £1,362,410 respectively, and taxation was £1,350,000, £744,570, and £792,000 respectively. It will be seen that Mufulira, because of the peculiar working of the war taxation law, was called upon to pay over $2,000,000 more in taxes than either of the others. Mufulira's splendid operating results arise from its treatment of the very high-grade ore which occurs in its upper workings. It is probable that it handled a richer average of ore last year than any other of the world's large producers. Mufulira has been granted a measure of relief in the matter of excess-profits taxation now which should increase its net earnings by some £70,000 annually. It is computed that the same amount of profit available for distribution to shareholders would have been made last year if less than half as much copper had been produced. In consequence, over half of Mufulira's total output was practically a present to the government. Adjustment for this probably will be made later, and in the meantime Mufulira will continue to produce at capacity as long as the war lasts.

▶ Rhokana and Roan Antelope both made considerable expenditure from their capital accounts last year. Roan did some diamond drilling on the Roan Extension area "to determine more accurately the limits and structure of the ore zone." Details cannot be supplied, as for the duration of the war the manager's report is withheld. A third reverberatory furnace was added to the smelter. Its labor force was considerably increased, necessitating the erection of many additional houses. Rhokana's capital expenditure was, it is declared, "necessary to provide increased capacity for output to meet war demands."

▶ The greatly increased activity of the Northern Rhodesian copper mines is reflected by the fact that Wankie Colliery Co., which supplies them, and also the railways and other industries in that district that depend for their prosperity chiefly on the copper mines, sold 1,282,939 tons of coal last year, an increase of 113,205 tons over the record for preceding year.

▶ December's half year Witwatersrand mining dividends came to £8,841,172. This compares with £9,748,000 in December a year ago. Something like four-fifths of the companies reduced their payments slightly. Van Ryn Deep

omitted payment. Three of the newer producers made high record profits in December—East Daggerfontein, East Geduld, and Western Reefs. Though these brighten the picture somewhat, it would seem that a trend is setting in towards diminishing production and profits in the Witwatersrand.

▶Cam & Motor has declared the usual year-end dividend of 1s. per share. Bailey Southwell, the chairman, said at the recent meeting that taxation, the royalties, and difference in the price of gold taken by the government the past year absorbed 69 percent of the full working profit, against 62 percent the previous year. He suggested that this tendency might have the effect of killing some of the geese that lay the golden eggs. Developments had been slightly disappointing at deep levels for the past two or three years and nothing new had been disclosed by diamond drilling; but a borehole from the 35th level crosscut of the new subvertical shaft—now completed to the 39th level—has recently cut an as yet uncorrelated reef which averaged 4.9 dwt. over a width of 12 ft. As working expenses were only 15s. 7d. per ton last year, this is to Cam & Motor a very good grade of ore; and half the width of the reef, foot, and hanging assays over 8 dwt.

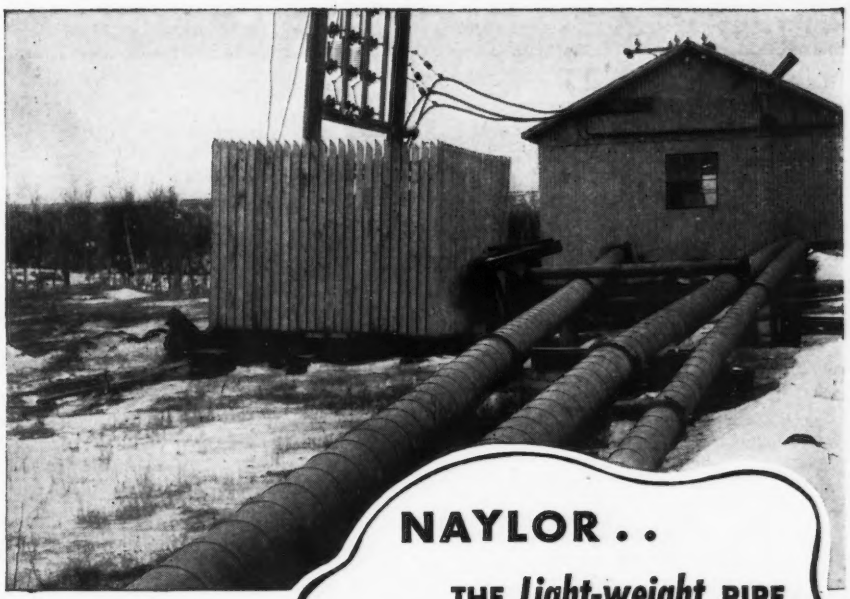
▶Rezende Mines has, for the first time since 1917, passed its dividend. It paid 12½ percent last year. Heavy taxation and difficulty of obtaining supplies account for no payment being made this year.

▶Geita Gold Mining Co., subsidiary of Kentan Gold Areas, made a working profit of £160,000 last year despite having to cut production severely during the closing six months because of inability to get supplies. After interest, depreciation, income tax, etc., a net profit of £59,386 remained, comparing with £61,397 the preceding year. Ore reserves were increased to 1,249,433 tons averaging 4.75 dwt. over widths averaging 65 in. Geita's 500-ton plant is now treating only 250 tons daily because of inability to obtain supplies for the mill.

▶R. J. Parker has resigned his directorships in the Beatty group of companies to take up a position in the United States. In recognition of his great services to the company—he having been the first to recommend exploratory work on the Roan Antelope property and having insisted that the Mufulira property be drilled when it already had been tested without result by shafts—the Roan Antelope company proposes taking out a 15-year endowment policy for £4,000 in his name and for his benefit and paying all premiums on it to maturity.

▶Gabait Gold Mines, now in liquidation, is selling its plant, machinery, and all other assets in the Sudan for £9,000. It made a profit of £1,002 the past year and is understood to have some £13,646 in hand. A final dividend of 1s. 3d. per share is forecast.

▶Sales of diamonds by the Diamond Trading Co. are reported to have been between £9,000,000 and £10,000,000 in 1942 or about £2,000,000 greater than in the previous year.



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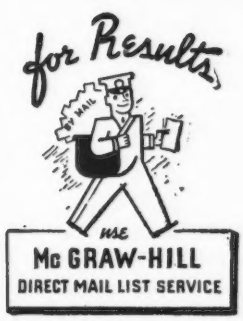

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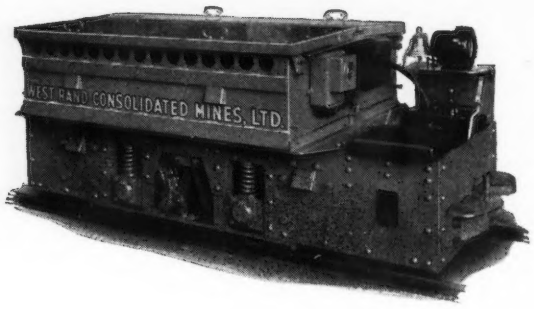

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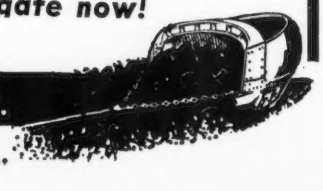

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AUSTRALIA

Kalgoorlie Mines Show Good Results

Edna May Amalgamated may recove tungsten—Broken Hill South improve grade and recoveries—Mt. Lyell increase capacity

▶ Gold Mines of Kalgoorlie, Ltd., wa formed in 1934 to operate a group o 12 old, abandoned leases on the Kal goorlie goldfield. These leases are situ ated on the eastern side of the Golde Mile and, with one exception, where a lease of the North Kalgurli company breaks the sequence, the various lease adjoin one another along the direction of strike of the lodes. So far, certain leases only have been selected for ex ploration and these initial mines have responded well to development. The operating company has a capital o £1,000,000, of which £610,000 has been issued. In the year which closed on March 31, 1942, an operating profit o £121,040 was earned.

▶ Although South Kalgurli Consoli dated, Ltd., on the Golden Mile at Kal goorlie, does not show spectacular re sults, the work accomplished is no less meritorious than that of its more prom inent neighbors. The ore is of low grade and at the time of the revival in Australian gold mining, ore reserves were insufficient to justify the remodel ing of the treatment plant as adjacent mines, more favorably placed as regards ore reserves and development prospects were able to do. The treatment plant is now the only one in the field in which dry crushing in ball mills and the roasting of the entire ore is practised, and though costs are rather higher than in those mills in which the flowsheet comprises flotation and roasting the flo tation concentrates, the recovery is in no way inferior, and in some respects is better than that obtained by the later method. A steady policy of development has gradually improved ore reserves, and it is probable that the life of this old mine will be much greater than might be inferred from the tonnage of ore blocked out. In the financial year which ended on March 31, 1942, the company earned a net profit from mining opera tions of £A26,085 and distributed £A18,- 750 in dividends. Underground work is proceeding at eight levels to the lowest horizon at 1,920 ft. in the two prin cipal leases comprising the property. The auriferous occurrences comprise several approximately north and south striking lodes together with cross lodes intersecting these at a somewhat acute angle.

▶ Edna May (W. A.) Amalgamated Gold Mines, N. L., which is operating a group of leases at Westonia, on the western side of Southern Cross, has been severely affected by the labor situa tion. In consequence, output has de creased, with a similar effect upon profits, and inability to maintain the necessary rate of development has re duced ore reserves seriously. The mill is at present depending upon remnant

re at the upper levels until the new bottom level at 575 ft. can be brought into production. Wolfram has been found to occur in the ore and the company is investigating old mill tailings produced by its predecessors on the leases. These tailings assay 0.5 percent WO_3 and laboratory tests indicate that about 75 percent is recoverable.

▶ The extent to which the Western Australian gold mining industry has been affected by prevailing conditions, and by government policy toward this branch of mining, is shown by the decrease in dividends paid in the nine months ended Sept. 30, 1942. In this period, the total distributed was £A247,390, compared with £A546,920 in the corresponding period of the previous year. The federal government policy has meant that previously prosperous inland towns which were supported by gold mines have either disappeared or have been seriously affected. Many schools, hospitals, and other social services have discontinued their services and other essentials provided by the State government, such as police, railways, and water supply, have practically ceased to function.

QUEENSLAND

Interesting information regarding progress at the mine of Mt. Morgan, Ltd., at Mt. Morgan, during the financial year which ended on June 30, 1942, was given at the annual meeting in Sydney on Oct. 29. The profit for the year was £A127,314, compared with £A45,857 in the previous year, due mainly to the treatment of a rather higher proportion of reserve ore and to higher-grade material obtained outside the ore reserves. The proportion of reserve ore milled was 30 percent of the total feed, the remainder being overburden of profitable grade. Overburden removed totaled 1,780,064 tons, an increase of 415,177 tons over the quantity removed in the previous year. In the six years which will end next June, approximately 11,000,000 tons of overburden will have been removed, but only 1,100,000 tons of ore reserve will have been treated. This is a ratio of 10 to 1, yet at the end of June, 1943, the ratio of total overburden to remaining ore reserve will be only 1.75 to 1. Operations throughout this period of overburden removal have been profitable and regular dividends have been paid, and in the past year the work of exposing the ore reserves has been greatly accelerated to increase the output of copper as quickly as possible. The Mt. Morgan company has unwatered and carried out considerable development in the Mt. Chalmers copper mine, about 30 miles northeast of Mt. Morgan. This work has been done at government expense and has shown that the mine is worthy of capital expenditure. The company has offered to advise and to supervise future management at Mt. Chalmers on a gratuitous basis.

▶ The mine of Golden Plateau, N.L., at Cracow, inland from Rockhampton, is one of the most important gold producers in the State. Despite the prevailing adverse conditions existing during the financial year which closed on June

(Continued on p. 116)

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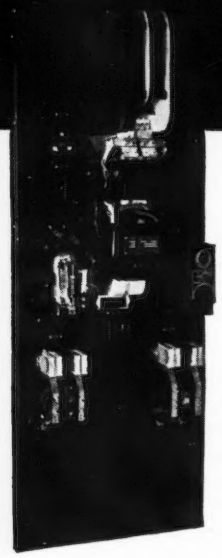

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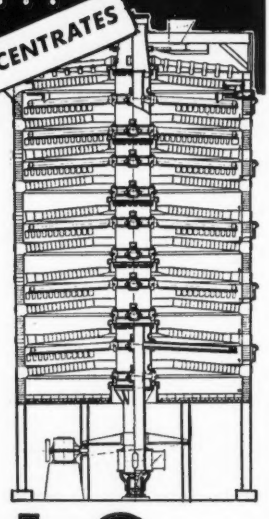

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▶AUSTRALIA

30, 1942, a net profit of £A125,457 was earned. Development was severely hampered by lack of labor. Stoping was similarly affected, and as a consequence the amount of ore milled was less than in the previous year. Due to restricted development, ore reserves are lower by 15,800 tons and 5,660 oz. of gold. To break the greatest tonnage possible with the limited labor available, more ore was drawn from the open cuts than has been the usual practice, and the grade was slightly lower as a result. The year's results are, therefore, very satisfactory, and shareholders received two dividends totaling £A84,000 during the period. The mine has been opened up to a depth of 644 ft. and for a total length of 2,000 ft. In this distance four shoots of ore aggregating 600 ft. in length have been stoped and in the Sunrise, or eastern end, a leading stope has been carried along a shoot of ore for a length of 150 ft. on the 544-ft. level, which is the lowest working in this part of the mine. The ore is quartzose, and the stopes vary in width from 10 ft. to 35 ft., with values of from 3 dwt. to 7 dwt. gold per ton. Ore is worked by cut-and-fill and shrinkage stoping. Ore reserves are estimated at 98,000 tons containing 23,240 oz. of gold, an average of 4.75 dwt. per ton, or with additional probable reserves, 121,300 tons containing 29,300 oz. of gold, an average grade of 4.85 dwt. gold per ton.

NEW SOUTH WALES

▶Broken Hill South, Ltd., has issued its accounts for the year ended June 30, 1942. In this period a net profit of £A247,392, of which £A129,000 came from the mining section, was earned. Dividends were paid amounting to £240,000 and £243,346 was carried forward. In accordance with wartime regulation, information as to production has not been published. Ore reserves are estimated at 2,100,000 tons and in this total no allowance has been made for ore disclosed by diamond drilling only, or by limited development work such as on the Western orebodies on the 1,370 ft., and 1,480 ft. levels, or ore below the 1,480 ft. level. The effect of the southerly pitch is steadily becoming apparent in the decreasing width of the orebodies as greater depth is attained. Development work completed totaled 3,505 ft., most of which was in connection with stope preparation and provisions of ventilation. Diamond drilling comprised 32 holes aggregating 3,229 ft., to check stoping boundaries and to obtain structural information for guidance in development work. At the 1,630-ft. level driving northward has been recommenced and will be continued to the boundary. On the 1,790-ft. level driving southward on the western orebody has shown the ore channel to be narrower than the drive. At the 1,940-ft. level the western crosscut from No. 7 shaft intersected the Eastern orebody which has subsequently been exposed for a length of 150 ft. with an average stoping width of 12 ft. The crude ore

eated in the concentrating mill was rather better grade than that milled the previous twelve months. Recoveies of all three metals were the best t recorded by the company.

TASMANIA

The withholding of figures on base-etal production at the request of the ederal government makes it difficult to epict the actual extent of operations the property of Mt. Lyell Mining & ailway Co. Ltd., at Mt. Lyell, on the est coast of the island. The company as for long been the largest producer copper in the Commonwealth and still aintains that position. The principal ining operation is the open cutting of he West Lyell orebody, which assays ightly over 1 percent copper. The ore loaded by power shovels and transorted by motor trucks to a transfer ass leading to the North Mt. Lyell nnel, through which it is hauled by ectric traction to the treatment plants. he company's year ended on Sept. 30, 42, and in it a net profit of £A155,615 as earned after charging £A8,487 for rospecting and development, £A62,645 r depreciation, and £A45,000 for taxaon. Dividends of 1s. 9d. per share were istributed. In comparison with preious years a larger tonnage of ore as mined and treated; the average rade of ore was lower; and there was small increase in copper production. pen-cut work was retarded by late deivery of new plant. Additions to equipent include two more power shovels f 2½-cu.yd. capacity and two more 0-ton semi-trailers which have assistd toward the increased ore production. reater milling capacity has been seured by two additional ball mills and 100-ft.-diameter thickening tank which as permitted a variation in flotation ethods. The finer grinding now posible has secured a higher-grade concenrate and an improved copper recovery, otwithstanding the lower grade of the re. Operations were adversely affected y shortage of both skilled and unskilled labor and the irregular delivery f spares and stores. Diamond drilling t West Lyell has shown a further large uantity of copper-bearing material with ittle variation at depth, and at Lyell omstock (which is worked by underground methods) information regarding he downward continuation of ore below o. 11 level is encouraging. Ore reerves are estimated at 14,850,000 tons ssaying 1.14 percent copper, 0.07 oz. ilver, and 0.012 oz. gold per ton.

Maps of Alaskan Zinc Deposits Available

ZINC DEPOSITS in Groundhog Basin, Wrangell district, southeastern Alaska, have been examined by a geologist of the Geological Survey, United States Department of the Interior, as a part of the Survey's program of investigation of deposits of war minerals. Preliminary maps have been prepared showing surface exposures and relation of several short tunnels to the deposits. A limited number of photostat copies of the maps will be available to those directly interested.

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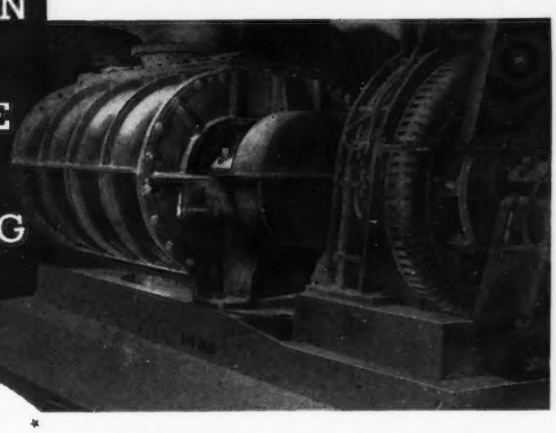

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In driving the 13-mile Continental Divide Tunnel, "R-C" Positive Displacement Blowers operating a reversing ventilation system are credited with speeding up progress 6 ft. per day by cutting 20 minutes from each drilling cycle. Blowers are used in series—one every 9,000 feet, with a capacity of 12,000 CFM. Write for latest Bulletin.

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303 Washington Avenue Connersville, Indiana

Roots CONNERSVILLE SINCE 1854 Rotary Displacement BLOWERS FOR POSITIVE VENTILATION

Equipment News

Spray Nozzles

PROPER WASHING of material passing over vibrating screens can be best accomplished by well-designed sprays so placed that maximum effectiveness is secured. Deister Concentrator Co., Fort Wayne, Ind., announces a new Concenco spray nozzle with which it is claimed that the aforementioned desirable condition can be obtained. The nozzles are clamped to the manifold pipe, averting the troubles attendant on the use of threaded nozzles, and by drilling oversize holes in the pipe, the nozzles can be aligned to provide an unbroken sheet spray across the entire width of the screen. The nozzles can also be staggered to provide a greater width of washing area. Although they are said to be non-clogging in action, the nozzles are easily removed for cleaning if that becomes necessary.

Glass Fiber Cable Hanger

FOR USE in mines, shipyards, and construction projects, a glass fiber cable hanger has recently been developed by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The new hanger is impervious to moisture and will not rot, stretch, or shrink, and it can support approximately 200 lb. The standard size hanger is 14 in. long and 1½ in. wide, and metal grommets in each end permit nailing to wooden pillars.

Solderless Connector

USE OF SOLDER having been curtailed by WPB order, M-43, Ideal Commutator Dresser Co., Sycamore, Ill., suggests a means of making strong mechanical and electrical connections without solder in the form of the screw-on connector known as the Wire-Nut. Ends of the wires to be connected are scraped clean and the Wire-Nut is screwed on to the stripped ends. A spiral spring molded into the connector presses its own thread into the wires. Five sizes are available for all combinations of wires from two No. 18 to three No. 10, solid or stranded.

INDUSTRIAL NOTES

Army-Navy "E" awards for excellence in the production of war materials have recently been given to the following plants: **Sharples Chemicals, Inc.,** Wyandotte, Mich.; **R. G. LeTourneau, Inc.,** Peoria, Ill., and Stockton, Calif.; **Allis-Chalmers Tractor Division,** Springfield, Ill.; **Bucyrus-Erie Co.,** Erie, Pa.; **Dow Chemical Co.,** Midland, Mich.; **The Austin Co.,** Cleveland, Ohio; and **American Cyanamid Co.,** Calco Chemical Division, Bound Brook, N. J. Renewals of "E" awards previously given have been made at the following plants: **Broderick & Bascom Rope Co.,** St. Louis, Mo.. **American Steel & Wire Co.,** Worcester, Mass.. **Handy and Harman,** Bridgeport, Conn.; **International Nickel Co.,** Huntington, W. Va.; **Philco Corp.,** Philadelphia, Pa.; and **Bausch & Lomb Optical Co.,** Rochester, N. Y.

B. P. Spann, for the past eight years advertising manager for **Gardner-Denver Co.,** Quincy, Ill., is now a lieutenant, j. g., in the Supply Corps of the U. S. Naval Reserve stationed in Philadelphia, Pa.

E. C. Fink, president and chairman of the board of **Mack Trucks, Inc.,** died in New York City on Jan. 1. He had been an officer of the company since its organization in 1911. **Louis G. Bissell** replaces him as chairman of the board, and **Charles T. Ruhf** has been elected as president of Mack Mfg. Corp. and executive vice-president of the parent company, Mack Trucks, Inc.

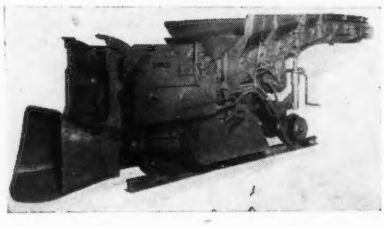
Joshua Hendy Iron Works, Sunnyvale, Calif., announces the acquisition of **Pomona Pump Co.,** Pomona, Calif., and **Crocker-Wheeler Electric Mfg. Co.,** Ampere, N. J.

James R. Hewitt has been appointed vice-president of **American Manganese Steel Division** of **American Brake Shoe & Foundry Co.,** Chicago Heights, Ill.

Robins Conveying Belt Co., Passaic, N. J., announces the appointment of **John T. Hoyt** as comptroller and **R. C. Gray** as works manager.

J. Willis Gardner, chairman of the board of **Gardner-Denver Co.,** Quincy, Ill., died on Feb. 1 at the age of 79. He was the son of Robert W. Gardner, who founded the Gardner Governor Co. in Quincy in 1852, and had worked his way up from a machinist's helper.

James A. Davis, former metallurgist with **Colorado Fuel & Iron Co.,** Pueblo, Colo., has been appointed to the technical staff of **Battelle Memorial Institute,** Columbus, Ohio.



Eimco Model 40 Tunneloader recently announced by Eimco Corp., Salt Lake City, Utah, in answer to a demand for an electric loader for large tunnel jobs. Capacity of 4 tons per minute has been recorded in certain installations

Foote Brothers Gear & Machine Corp., Chicago, Ill., announces the appointment of **B. H. Quackenbush** as assistant sales manager.

Charles A. Crane has rejoined **Templeton, Kenly & Co.,** Chicago, Ill., as assistant to the president. Mr. Crane participated in building the first Simplex jack in 1899, but later left the company to enter the construction field.

The Galigher Co., Salt Lake City, Utah, has moved from 228 South West Temple St. to Motor Ave. and 2d East, the entire building in which the company was located having been taken over by the Army Engineering Corps.

Metallizing Co. of America, Chicago, Ill., announces the establishment of a new engineering service program designed to assist industry on all problems relating to salvage, conservation of materials, and the use of substitute metals for the more critical ones.

M. L. Carson, acting engineer in charge, has been appointed manager of the engine and condenser department of **Allis-Chalmers Mfg. Co.,** Milwaukee, Wis.

BULLETINS

Transformers. Power and distribution transformers and other electrical distribution equipment are completely described in Bulletin B-6186 of Allis-Chalmers Co., Milwaukee, Wis.

Ro-Flo Pumps. Allis-Chalmers Co., Milwaukee, Wis., has released Bulletin B-6211, which describes Ro-Flo pumps and compressors. Complete operating data on these light-weight units are provided.

Centrifugal Pumps. "Handbook for Wartime Care of Centrifugal Pumps" is the title of a new publication of Allis-Chalmers Co., Milwaukee, Wis.

Mine Locomotives. A 33-page booklet covering operating tips, trouble checks, parts, lubrication, and inspection charts of mine locomotives can be obtained by writing Dept. 7-N-20, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Wartime Conservation. Achieving the best possible output with electrical equipment, together with the greatest saving in critical material, is the subject of a 96-page booklet just issued by Westinghouse Electric & Mfg. Co., Dept. 7-N-20, East Pittsburgh, Pa.

Lubrication Chart. Proper methods of lubricating the various types of LeTourneau earth-moving equipment are given in a reference wall chart prepared by R. G. LeTourneau, Inc., Peoria, Ill.

Transformers. Bulletin GEA-897-J, published by General Electric Co., Schenectady, N. Y., describes a series of dry-type transformers for use in lighting or power circuits of 600 v. or lower.

Arc Welding With A.C. A new 12-page booklet of Westinghouse Electric & Mfg. Co. describes operation of a.c. welding machines and the advantages this method presents for certain types of work.

Strain Gages. Three new technical bulletins describing the company's SR-4 strain gage and the recording and indicating instruments supplied for it have been issued by Baldwin Locomotive Works, Philadelphia, Pa.

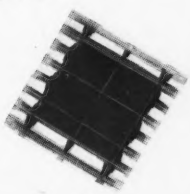
Industrial Products. Whiting Corp., Harvey, Ill., has prepared a 24-page picture book called "Whiting Products for Industry," which presents pertinent facts on the wide variety of heavy-industry products manufactured by the company.

GET OUT MORE ORE AT LOWER COST WITH PHILCO XL BATTERIES!

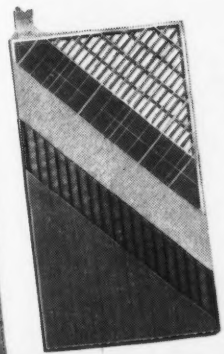
Heavy-duty Philco XL Batteries will keep your Joy Shuttle Cars or mine locomotives on the go 10% longer between charges! Plate for plate, Philco XL Batteries pack 10% greater capacity at no increase in overall size. They'll give you sustained high voltage and extra wallop, too . . . the kind of power that gets out more ore at lower haulage cost per ton!

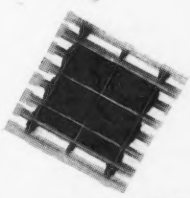
Today Philco is set up to give you better service than ever before. Our storage battery production capacity has been *tripled*—that's why you get far better than average deliveries from Philco. And with a local Philco Battery Sales Agent in almost every mining center, you get the help you want, when you want it! Return coupon for new Philco Mine Battery catalog.

10% GREATER CAPACITY...SUSTAINED HIGH VOLTAGE...LONG PRODUCTIVE LIFE



(*Upper right*) Philco "K" Process produces a flint-hard, porous plate with superior bond between active material and grid. (*Lower right*) Ordinary plate drying.





(*Left*) Philco Triple Insulation adds months of service by sealing active material into grid with Glass Fibre Mats, Slotted Rubber Retainers, rugged Philco Separators.

REPLACE WITH RUGGED, HIGH-CAPACITY

PHILCO

MINE LOCOMOTIVE AND SHUTTLE CAR

BATTERIES

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What's New IN SAFETY

NEWS ABOUT SAFETY EQUIPMENT AND METHODS

Winter comfort

Cool breezes through safety hats are swell in the summertime, but head protection must go on the year 'round. To prevent frosted ears and head drafts, a full, snug-fitting cap with ear flaps is available. This cap is made of sturdy, flannel-like material, with ear flaps covered with leatherette which acts as a wind break.

To attach this winter liner to the Hard Boiled Hat, it is necessary only to snap it into the crown, just as you would a conventional sweatband. The band—which is sewed right into the liner—contains the necessary snaps.

Foot puncture season...

In rainy weather, foot puncture wounds become more frequent around construction work. The reason: boards with nails exposed become covered with water and mud; workmen wear easy-to-puncture rubber boots to keep their feet out of the ooze. Take this precaution: supply each man with a pair of Bullard protective insoles. They were made specifically for wearing inside rubber boots; are extremely flexible, tough, and comfortable.

★ ★ ★

More complete information on any of the above items may be had by writing for product literature. Descriptions are condensed from the bulletin "What's New in Safety," which will be mailed to you monthly on request.

E. D. BULLARD CO.

275 EIGHTH STREET, SAN FRANCISCO, CALIF.

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EVERYTHING BULLARD IN SAFETY

Washington Reflections

(*Continued from page* 50)

Lend-Lease shipment and for use of the government's mints in producing nickel coins. The supply, which has been increasing as the pilot-plant operations approach a regular production basis, represents the output to date of the $2,000,000 test plant provided by Congress in 1940.

Boulder City manganese, which has been recovered at as high as 99.9 percent purity, is being used in nickel coins because experiments showed a need for a pure metal to provide the hardness, durability, electrical resistance, etc., required in coins. Use of a 9 percent manganese, 35 percent silver and 56 percent copper formula for the nation's 5c. pieces was decided upon as a means for saving copper and nickel—both of which are more scarce than manganese. The old formula was 75 percent copper and 25 percent nickel.

Beryl Experience Wanted

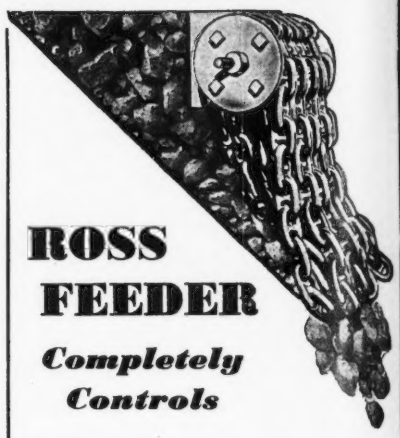
PREWAR domestic output of beryl amounting to about 200 tons per year was enough to satisfy the demands at that time. But since Pearl Harbor the requirements have increased rapidly and a good many thousand tons of ore will have to be imported in 1943 to satisfy demands unless domestic production can be stepped up sharply.

Mechanical concentration will be necessary if the output of beryl in this country is to be increased, as the increase must come from lower-grade deposits where hand picking, usually practiced, would be out of the question. All persons who have done any work on the concentration of beryl could aid the war effort by explaining their methods and equipment to the proper government officials. Letters addressed to *E. & M. J.*, Room 1240 National Press Building, Washington, D. C., will be delivered to the right place.

Copper Wage Boost

THE Office of Economic Stabilization lost prestige when it gave as the reason for granting the wage boost to the miners in the Michigan field that a labor shortage existed in the area. The facts are that the number of men at work in the mines had increased steadily at the prevailing scale.

Making the increase retroactive was in keeping with the often expressed policy that the ability of the company to pay has no bearing. In the present instance, the action was sharply criticized by mining men, and even government officials familiar with the problems of the Michigan copper mines expressed themselves privately as being strongly against this part of the decision.



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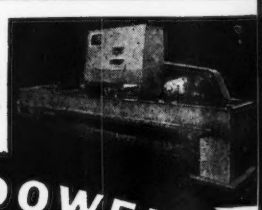

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Where control of feed improves efficiency — as in weighing feed of ores to ball mills — the Merrick FEEDOWEIGHT gives perfect results. Weighs and Regulates separately. Continuously totalizes weight. Gives better control of grind. Used and approved by leading mill properties. Simple—rugged — "foolproof."

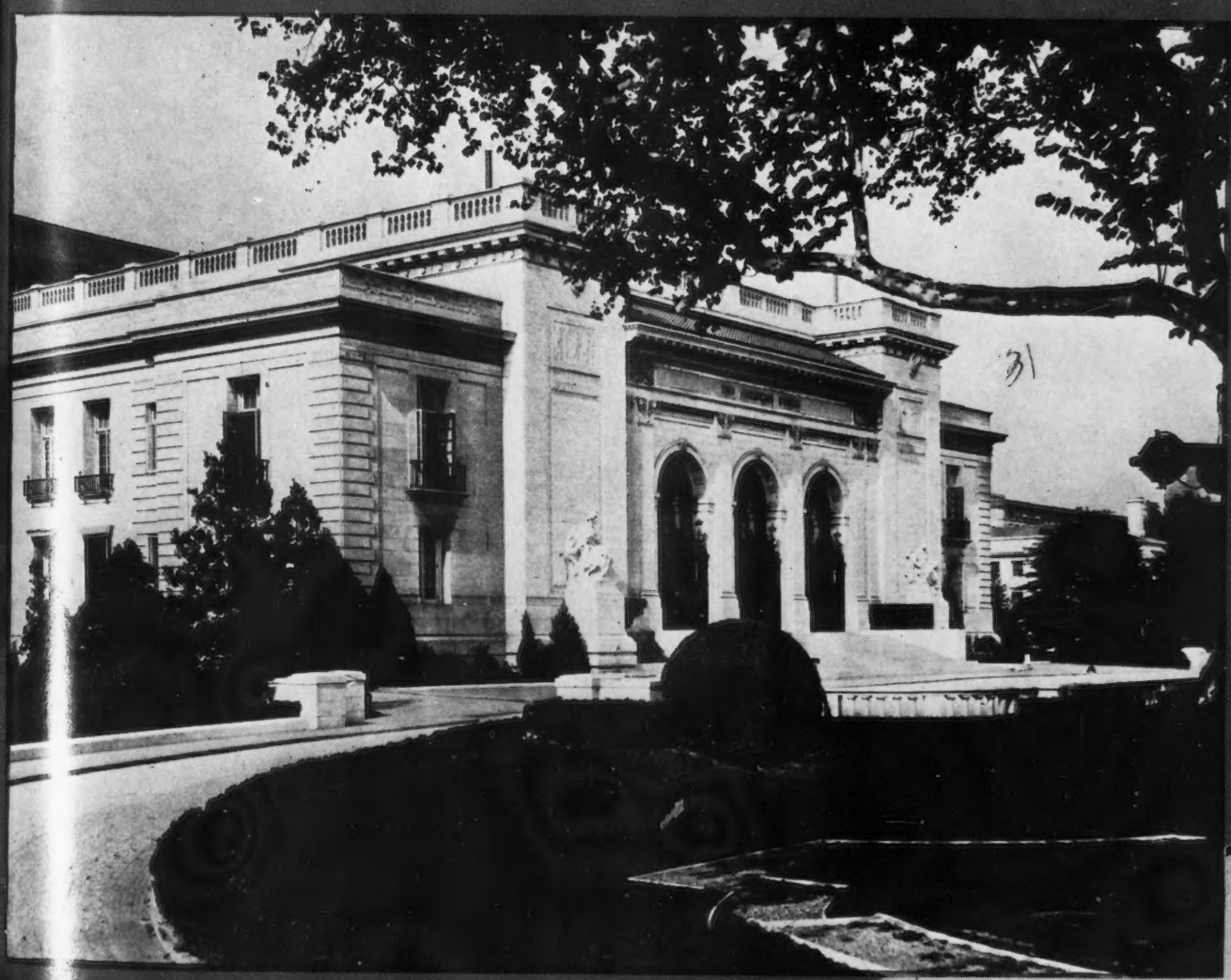
FOR BETTER CONTROL

BULLETIN 551 FOR DATA

MERRICK SCALE MFG. CO.
PASSAIC, NEW JERSEY, U. S. A.

ENGINEERING AND MINING JOURNAL

APRIL, 1943



Pan American Union Building in Washington, D. C. Here the Union has its international headquarters

PRICE 50 CENTS

In this issue

HEMISPHERE SOLIDARITY—Nelson A. Rockefeller
FOREIGN MINERALS FOR THE WAR—Alan M. Bateman
Yellow Pine Mine, Unique Metal Producer
Tariff, Reciprocal Trade, and Mining
United Feldspar's Pyrophyllite Enterprise
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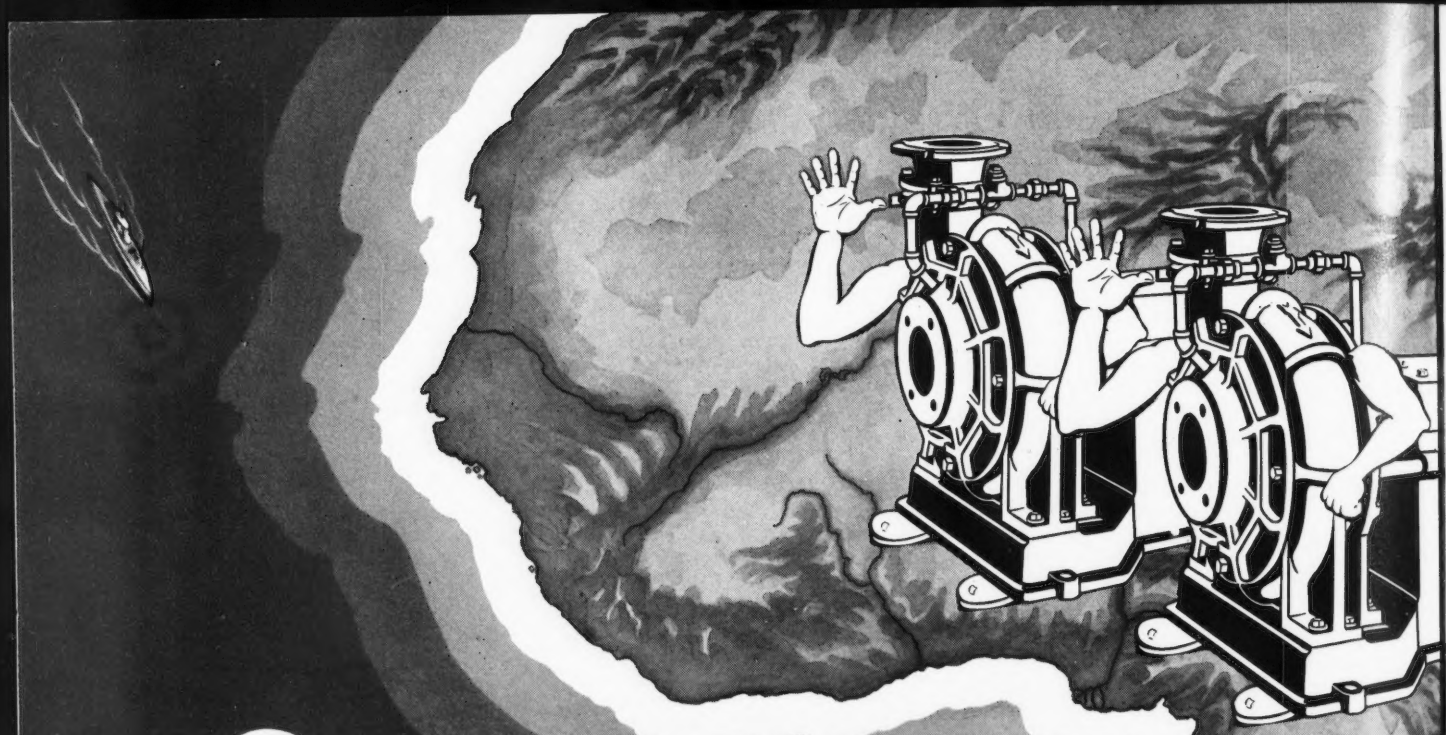

D... THE TORPEDOES WE ARRIVED SAFELY

An African mine producing strategic war metal needed two large size pumps. Their New York purchasing office selected Hydroseals, but alas, they never arrived. Two more pumps were quickly assembled and shipped. They arrived safely and are now doing their part in defeating the Axis. . . . These Hydroseal Pumps each have a capacity of 2080 Imp. Gals. per minute of Slime and Ore laden water, having a specific gravity of 1.1. The static head is 45' and the pipe line about 85' long. . . . Wherever you are located, if you need Hydroseal Pumps to hasten the day of Axis "Unconditional Surrender," please get in touch with the nearest office listed below.

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PACKLESS ACID PUMPS AND

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After the War, What? O. W. Roskill, London consultant, thinking of the Atlantic Charter, turns the spotlight on tomorrow's problems. A dozen present themselves, each a question mark. Among them: The social and political results of closing high-cost producers? Prices, costs, and level of output? Continuance of wartime controls? And others. Mr. Roskill's discussion will appear next month.

▼

Draw-point Spacing—the distance between finger raises, center to center, at the undercut level in the block-caving method of mining, varies between 11 and 50 ft. in nine important properties. Why so great a range, is an interesting and important question, this factor having its bearing on both safety and economy of operation. Experimental investigation of the subject will be discussed in the May issue by P. B. Bucky, J. W. Stewart, and Stephen Boshkov.

▼

Magnesium for planes, bombs, flares, and other things, where light weight or simply light is wanted! Magnesium in crowns, too, though not of the sort that grace the royal head. These are the crowns that form in the ends of the condensers on the retorts used in the Pidgeon process plant in eastern Canada. They are melted and cast to form the ingots shipped. A staff article describing this plant has been prepared, which we hope will pass the censor.

▼

Attention! Our chests *are* out—pardonably. The Office of War Information has requested permission to reprint for European, Asian, and African publications the editorial "Mining—Number One War Industry," which appeared on pages 61 and 62 of our February Annual Survey and Outlook Number. It will be translated into several languages for this purpose.

A. M. STAEHLE
Publisher

ENGINEERING AND MINING JOURNAL

R. M. WARD
Manager

Published by McGraw-Hill Publishing Co., Inc.
H. C. PARMELEE
Editor

Contents for APRIL, 1943

Vol. 144, No. 4

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COVER ILLUSTRATION: Pan American Union Building in Washington, D. C. Here the Union has its international headquarters
Press Association, Inc., photo

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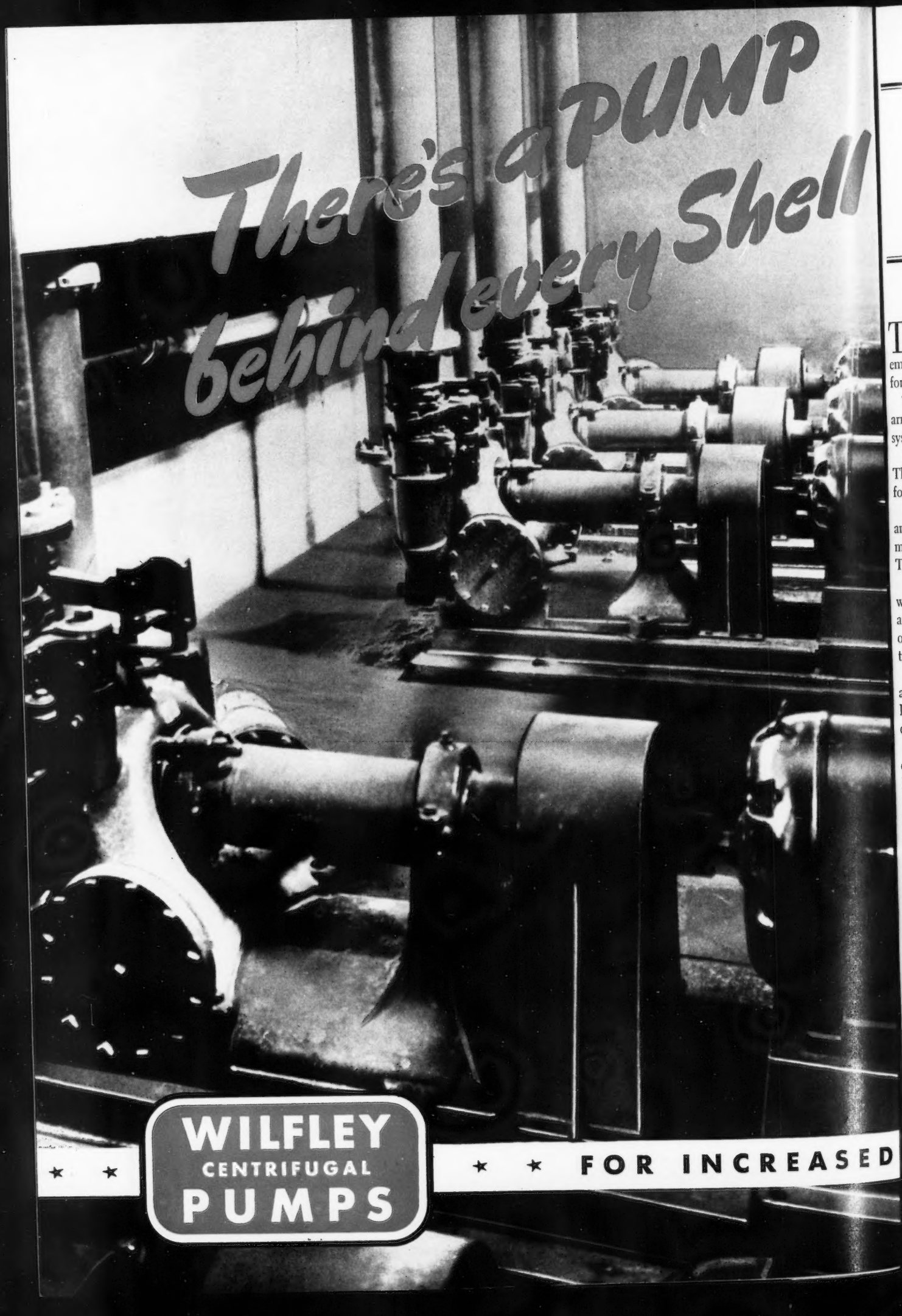
There's a PUMP behind every Shell
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Food—The Deciding Issue

Our food problem remains to be solved

THE first thing the Germans did when they occupied Czecho-Slovakia, Poland, Belgium, France—was to empty all warehouses. Everything went into trucks headed for Germany.

The Nazis knew that this war would be won by the army that had the most supplies and the best supply system.

The Nazis knew that supplies are as essential as guns. They knew that the most essential of all supplies is... food.

Being the only people on earth who can watch women and children starve, the Nazis seized upon food as their most powerful instrument for disciplining the masses. They added famine to their arsenal of conquest.

The flocks and herds of Europe are being consumed with alarming rapidity. The desperate shortage of meats and fats is growing steadily worse. Our Allies are short of certain foods that we must supply if we expect them to carry on.

And as we supply them, as our imports are curtailed, as our fighting men consume more than they do in civil life, and as we fail to increase our production rapidly enough . . . we, too, become short of certain foods.

Former President Herbert Hoover, speaking before a conference of the Governors and Representatives of twelve Mid-Western farming states in Des Moines on March 15th, sounded the warning that American agriculture, beset by Washington bungling on manpower, farm machinery and price systems, strangling production and distribution, is facing a deterioration which may bring on a national food shortage such as led to the collapse of Russia, the defeat of Germany in the first World War and the fall of France in the present war. Unless this deterioration is stopped, warns Mr. Hoover, we cannot hope to win the present conflict.

Complications of similar magnitude face the food processor and the distributor.

Never in the history of the world has man's dependence on food been so crucial. Yet it is not easy for us to grasp the full significance of the crisis. We are so accustomed to finding milk, eggs and butter on our doorsteps every morning, we are so used to filling our pantries from the shelves of our grocers and markets that we accept food as something that is due us on demand. We do not stop to think that we never are more than a few meals ahead of famine.

But this picture has changed. Now we are faced with food rationing, and every day the shelves of our food markets become more bare.

* * *

Let it be noted that the appointment of two Food Administrators has not solved the food problem. It is still with us; daily it becomes more critical. Unless it is solved, and solved quickly, the very food that ex-Food Administrator Wickard said would "win the war and write the peace" may lose the war and lose the peace.

Put very simply and clearly, the food problem amounts to this: we are trying to feed upward of 200 million people. We are trying to do it with the farms and other facilities that heretofore have been capable of feeding about 145 million people (our present population plus a 5% surplus).

Had the Government foreseen the need and planned ahead, we could have begun by 1941 the enlargement of our farm production and food processing capacity. Two irreplaceable years have been lost!

The gravity of the situation becomes apparent when we consider that 50,000 factories are required to process our foods. Food processing not only is America's biggest industry—it is one of America's most important for, without processing, most foods would perish before they could reach the consumer. The term "processing" covers the salting, drying, smoking, pickling, chilling, canning, packing and other methods of preservation that make it possible for us to eat in 1943 food that was produced in 1942. Few realize that most of the food we shall eat in 1943 was produced and processed last year, that most of the seed we plant this spring will grow food for 1944 or perhaps later.

In one important process of preservation, tin and rubber are vital materials. When the Japs captured Malaya and the Netherlands East Indies more than half of the world's tin and nearly all of its rubber fell into their hands. This forced drastic changes upon our entire food economy. The importance of tinplated steel containers, tops for glass jars and rubber gaskets is fairly obvious... metal food containers alone consume, every year, more than 2,700,000 tons of steel.

The aggression of Japan has snared our whole food industry in a maze of intricate packing problems. It has enforced recognition of a new principle of food technology, i.e., that the *method* of food preservation is determined by the *type* of container available. The tin, steel and rubber stringency compels many food processors to adopt

unfamiliar methods — methods that call for a great deal of new equipment. This, in turn, involves the use of critical materials that are so urgently needed for other war purposes.

This conversion of the food processing industry to meet these exacting restrictions has been greatly complicated by two factors that have increased its wartime burden. Indeed, it is these that provide the principal reason for civilian food rationing.

The first of these is the task of feeding our armed forces overseas. Allied ships are being sunk at an alarming rate and the loss of cargo is considerable.

The second factor gravely augments the first. Under Lend-Lease our country is undertaking to feed our Allies to the extent of approximately 60 million people.

Types of food required for Lend-Lease and the armed forces are the finest we can produce. They are the high protein foods, especially meats, cheese and milk; and the protective foods which rate high in vitamin content. Peculiarly enough, the more valuable a food is from a nutritive angle, the more specialized is the processing required to preserve it.

The food processing industry, handicapped as it is, is meeting today's challenge with resourcefulness and enthusiasm . . . despite container complications and shipping shortages.

This is the tenth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

It is accomplishing its Herculean task by resurrecting and modernizing a method of food preservation that is as old as mankind. Probably you have read a great deal about dehydration. You actually may have eaten dehydrated food, but right now nearly every bit of dehydrated food is earmarked for the armed forces or for Lend-Lease.

Food processing never will be as spectacular as the production of bombers or tanks. But under today's conditions, the performance of the food processor is no less important . . . no less inspiring. When we consider that dehydrated food is compressed into solid blocks with a density nearly equal to that of coal, so that almost a whole meal can be carried in a vest pocket, and that half of the shipping space is thereby saved in transportation, we begin to appreciate what the processors have contributed to meet the food problem imposed by the war.

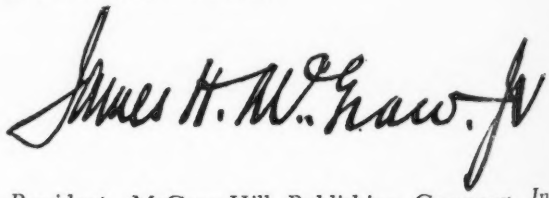
But they have not only contributed new methods, they are achieving new highs in production. And now they are asked to do what borders on the impossible. Consider dehydrated egg powder. Normal production in pre-war years was about 3,000,000 lbs. In 1940 this was increased two and one-half times, in 1942 it was stepped up again, this time forty-fold. And in 1943 the call is for another 60 per cent boost, to make a total of 480,000,000 lbs. Dried milk powder production of 350,000,000 lbs. in 1940 must be increased to 685,000,000 lbs. in 1943.

Vegetables, which were a small item to the processor before the war, now are dehydrated in enormous quantities. The vegetable dehydration industry has had to grow by leaps and bounds without benefit of the high priorities accorded to arms, ship and aircraft building. Production of dehydrated vegetables in 1942 was four times that of 1941, and 1943 calls for a sixteen-fold increase over 1942.

Total dehydrated food production in 1943 is scheduled at 1,750,000,000 lbs., dry basis . . . *all for export*. Multiply that by 10 and you have a rough approximation of the astronomical amount of raw materials that will have to be produced.

Many problems remain to be solved in the troublesome days that lie ahead. But with all his resourcefulness, man has little control over the weather. A severe drought could wipe out all of man's carefully laid plans. If we are tempted to reassure ourselves with the thought that the food situation probably is not so serious as it is painted, it will be well to remember that last year's crop increase over 1941 was due to better than average growing weather.

The war-bred food crisis that now confronts us will be met only by immediate measures to insure a food production ample to allow for adverse weather conditions. The food processing industry is capable, but has not been granted the needed help, in coping with its tasks. The food problem as a whole involves all three functions of production, processing and distribution. And if we are to master the problems that now beset us, all three of them must be coordinated under a single administrative control. "Food will win the war and write the peace". But if American food is to do that double job, we must develop a capacity for food *administration* comparable with the genius of our food industries.



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